COAL AGE

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DEVOTED TO THE OPERATING, TECHNICAL AND BUSINESS PROBLEMS OF THE COAL-MINING INDUSTRY

SYDNEY A. HALE, *Editor*

New York, December, 1934

Hanna of Ohio

STUDIES of progressive management invariably reveal two basic and complementary qualities—vision and the courage to follow that vision along paths carefully mapped out by prudent planning and bold experimentation. Experience is respected, but, if the logic of the situation dictates a break with established practices, tradition is valued only as a check upon the soundness of new conceptions. And achievement of immediate objectives is only a sharp reminder that tomorrow's goals lie still further on.

THESE PRINCIPLES and qualities find concrete expression in the operations of the Hanna Coal Co. of Ohio. In their practical application, they are developed along at least four major lines—advance planning, simplification, concentration and a willingness to embrace new methods. There are companies which make plans on such a grand scale that the details of day-to-day operation are left to chance decision. Hanna management endeavors to know not only where it is going next year but just what it shall do today.

ADVANCE PLANNING necessarily encourages simplification. The essence of such planning is the elimination of the confusion which frequently accompanies attempts at spontaneous coordination after the wheels actually are in motion. With advance planning, each man knows what is expected of him, the tools for performing his job are ready and busy aimlessness is without excuse. The attack is direct and productive because the line of action has been predetermined.

CONCENTRATION has become a word to conjure with—particularly in mechanized operations. But Hanna has demonstrated that it also can be applied effectively to hand-loading mines. As a result, production at both the hand-loading mines and the mechanized operation at Fairpoint is confined to relatively limited areas of development. Men and equipment are more efficiently employed and supervision is an easier task.

FAIRPOINT is convincing evidence of the willingness of the company to experiment with new methods. Still more significant, however, is the fact that out of this experimentation has come the decision to extend mechanization to other operations where conditions justify the expenditures. Management is keenly conscious that modernization must be dynamic and continuous—not static. Because of the work already done and the projects planned for the future, the Hanna Coal Co. has been made the theme of the Fourteenth Annual Model Mining Number of *Coal Age*.

Distinction Without Difference

FROM TIME to time, NRA announces that this or that industry has been granted temporary exemption from code-hour provisions to take care of holiday rush demands for goods and services. When Rocky Mountain coal producers appeal for flexibility in maximum hours to take care of fluctuating peak demands, deafness descends upon the administration. Possibly there may be a line of demarcation between the legitimate demands of the coal industry and the legitimate demands of other industries and trades, but until NRA vouchsafes magnification, the line will remain too fine for observation with ordinary vision.

Should Air Circulate?

IN ACCEPTED mining parlance it is stated that "air circulates through the workings." Hidden behind this expression is the well-established idea that the air should go through the mine and then return, just as the blood goes through the arteries and back through the veins. But the venous blood of the human body needs purifying and comes back to the lungs for that cleansing and to the heart for recirculation, whereas the mine air no one wants either to purify or to use again, so there is no need to bring it back if an exit can be found for it. The sooner it leaves the mine, after it has loaded itself with impurities, the better for all concerned.

In many cases, a convenient opening or shaft would enable it to leave the workings after it has ventilated a section or the whole of a mine, saving half the travel and perhaps far more than half the resistance, for the return usually is badly cluttered. Use of the return airways of development as intake airways for the already developed area would vastly reduce power, upkeep and brattice costs, and even simplify haulage immensely.

It is almost inevitable in opening a mine that the fan be placed near the mine portal, and it is obvious that at first the air must be brought back after its work is done, for there is no remote inlet or outlet by which it can leave. Again, when the mine nears its end, it probably will have to be worked once more with both intake and return, for the remote inlets and outlets then will be inaccessible. But between these are long intermediate years of costly ventilation during which the air might be delivered to, or taken from, an advance shaft or a drift with great efficiency, giving to the existing fan work more nearly within its powers. To circulate or "home" air is a work of supererogation. It is enough if it traverses the workings once.

Three-Way Loss

HOW wage earnings should be tabulated for Form "C" of the NRA statistical study of bituminous code operation continues to plague coal producers and government officials. Because the industry has not been able to agree within itself, the data are now being compiled in at least three different ways. If the information is to have any value for comparative purposes, it is obvious that one district cannot use one basis, a second district another and a third still another basis. The net result of such procedure is only a three-way loss.

Gas Drainage

WHERE coal is dense and has been for eons under heavy compression it does not readily yield up its gas; accordingly only that which is near the face of the coal is drained away; high pressures can be obtained in sealed boreholes; the face may be pushed out and broken down by pressure of the gas, and coal may be thrown out in outbursts of great magnitude. The permeability of our coal and its less heavy compression probably explain the disparity of the action of gas in America. Development here draws volumes of gas from over a large area, whereas in Europe, despite higher pressure, it draws from an area far more circumscribed. Gas in America comes mostly from development, usually is rapidly discharged and as rapidly depleted.

Rooms, when driven, produce less gas than headings, and pillars much less than either. Driving headings well ahead of actual coal removal, therefore, may reduce the methane content of the field to more manageable proportions, but the ventilation of such headings during their advance is likely to be fraught with danger and difficulty. Gas in the clay bottom or shale top, on the other hand, may be more closely held and less readily bled away.

HIGHLIGHTS

+ In Hanna History

Hanna and the Ohio coal industry have been linked together for more than seventy years. This long association has not only made the Hanna name an outstanding one in the annals of Ohio coal mining but also laid the foundation for a great enterprise spreading southward from the iron ranges of Michigan to the Gulf States and eastward from the Great Lakes area to the anthracite region. Today the pioneering spirit that created this network of industrial activities is finding a new outlet for its energies in leading the modernization movement in the coal fields of the State in which it was born.

DIRECT connection with the Ohio coal industry began in 1867, when Marcus A. Hanna, then turning thirty, quit the wholesale grocery trade to cast his lot with the more exciting coal and iron business of his father-in-law, Daniel P. Rhodes. The Rhodes family had been active in mining for many years. Ohio left its first permanent imprint on the national tonnage records in 1838; in 1845, Daniel Rhodes and David Tod were working the Briar Hill mine, near Youngstown.

Starting with an output of approximately 50 tons per week—shipped by canal to Cleveland—production was stepped up sharply with the completion of the Cleveland & Mahoning Railroad in 1856. The county in which M. A. Hanna was born was brought into the production picture a few years later when the Cleveland & Pittsburgh Railroad opened up the Columbiana field. North and South were in the throes of the bitter debate which in a few short months would lead to the Civil War when the firm of Rhodes, Card & Co. extended its operations into the Massillon district.

With the admission of M. A. Hanna and Robert R. Rhodes into the partnership and the retirement of John F. Card in 1867, the firm name became Rhodes & Co. This name was continued through several changes in partnership until the withdrawal of the last of the Rhodes family in 1888, when the name was again changed—this time to M. A. Hanna & Co. Robert L. Ireland, Sr., father of the present executive vice-president of the Hanna Coal Co., was made a partner in 1904. William Collins, now vice-president of the M. A. Hanna Co. and president of the Hanna Coal Co., was admitted into partnership in 1917.

At the time the firm was incorporated as the M. A. Hanna Co., on Dec. 9, 1922, its major interests included extensive iron-mining operations in Michigan and Minnesota; blast furnaces in New York, Michigan and Ohio; a fleet of freighters plying the Great Lakes; coal mines in eastern Ohio, western Pennsylvania and southern West Virginia, with a combined annual capacity of approximately 3,000,000 tons; and the anthracite operations of the Susquehanna Collieries Co., with an annual output of approximately 4,000,000 tons. In addition to selling the coal of its various subsidiaries and wholesaling coal of non-affiliated mines through the Hanna Coal & Dock Co. the parent corporation also was active in buying ore for its own account and on sales or operating contracts with independent companies.

As a result of changes effected in 1929, the Hanna organization again became primarily a coal institution. The principal iron mines and furnaces operated by it were transferred to the National Steel Corporation, with Hanna retaining the management of the ore lands and freight vessels turned into the new steel combination. In May, 1930, the Hanna Coal Co. was incorporated to take over the Ohio coal properties then operated as the Wheeling & Lake Erie Coal Mining Co. Hanna western Pennsylvania bituminous operations, following the earlier fate of its West Virginia mines, passed to the control of a non-affiliated organization. The story of the Ohio mines is told in detail in the pages that follow.

WHO'S WHO IN HANNA

·I·

WILLIAM COLLINS
President Hanna Coal Cos.
(Delaware and Ohio)

L. N. CANNON
Secretary-Treasurer
Hanna Coal Co. of Ohio

FRED W. BRAGGINS
Sales Manager
Hanna Coal Co. of Delaware

R. L. IRELAND, JR.
Executive Vice-President
Hanna Coal Cos.
(Delaware and Ohio)

R. V. CLAY
Vice-President and
General Manager of Operations
Hanna Coal Co. of Ohio

P. C. SPRAGUE
Vice-President
Hanna Coal Co. of Delaware

R. S. WALKER
Consulting Engineer
M. A. Hanna Co.

MANAGEMENT

+ At Hanna Coal Co.

SUCCESSFUL MANAGEMENT of any industrial enterprise involves many, and frequently changing, problems of planning and execution. Basically, however, it must inevitably rest upon two major factors. The first, which embraces what is sometimes termed the philosophy of management, is a clear-cut determination of objectives. The second fundamental is the mechanism adopted for the coordinated projection and control of actual operations. But, unless these two factors are truly complementary, either may defeat the other. Attainment of the desired objectives may be frustrated by the adoption of a faulty mechanism: a perfectly sound mechanism may be made ineffective through the failure of management to revise its objectives to overcome weaknesses revealed by the operation of that mechanism.

The complementary nature of these two factors, however, is very much in the forefront of management thinking in the Hanna bituminous coal interests. Hanna management policies are grounded upon three definite and controlling convictions. These are:

1. The desirability of concentrating production in a few mines with relatively small hourly capacities and relying upon double- and triple-shifting to take care of seasonal surges in demand.

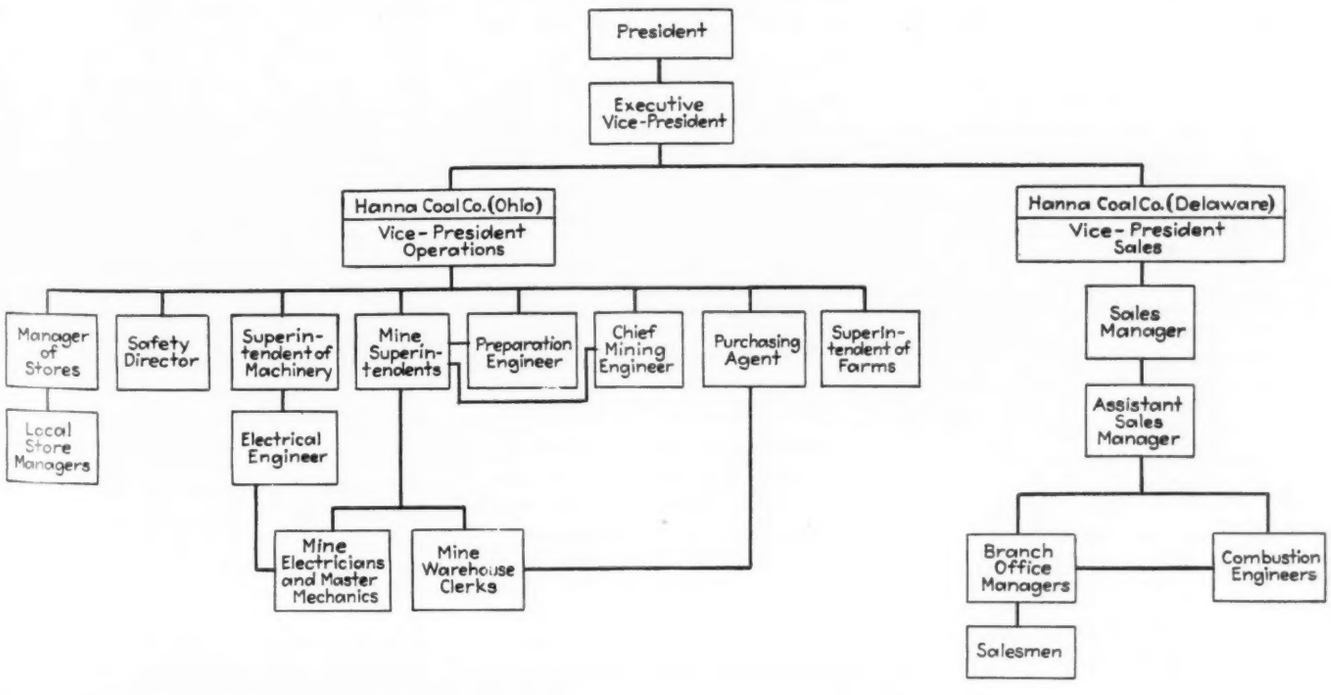
2. Adoption, in so far as full experimentation demonstrates both their adequacy and their adaptability to local mining conditions, of new developments in technique and equipment for reducing production costs and increasing the marketability of the coal.

3. Ruthless abandonment of properties which cannot be made to meet established market and cost bogies.

Ten years ago the Hanna bituminous interests operated 24 mines in three States; today, operations are concentrated at six mines all located in the eastern Ohio field. These are the Fairpoint No. 9, Lafferty No. 6 and Willow Grove No. 10 mines, in Belmont County, and the Dillonvale No. 1 and Piney Fork Nos. 1 and 2, in Jefferson County. The Piney Fork operations are owned by the Jefferson Coal Co. but operated by the Hanna Coal Co. Only two of this group—Dillonvale No. 1 and Lafferty No. 6—were among the 24 controlled by the Hanna interests in 1924. The Fairpoint property was purchased from the Troll Coal Mining Co. in 1929.

Willow Grove and the Lydia mine of the Big Five Coal Co. were acquired by the Hanna interests late last year. The Lydia mine was promptly dismantled. In another and earlier case, two mines were abandoned within a few days after the close of the month

Fig. 1—Organization Chart: Hanna Coal Co., the Operating Organization, Left, Is the Hanna Coal Co. of Ohio; the Sales Organization, Right, the Hanna Coal Co. of Delaware; Both Companies Have the Same President and Executive Vice-President.



in which they had shown the highest production and the lowest cost per ton in several years. From the Hanna standpoint, however, the production was too low and the cost too high.

Many producers with a large string of mines endeavor, as far as possible, to divide working time in the hope that some day increased demand for coal will absorb a greater share of the productive capacity thus kept available. Not so with Hanna. Unless there is reasonable assurance that anticipated sales for the year will absorb at least 80 per cent of the daily output of a mine, that operation goes on the permanently retired list. The idle-day cost for maintaining the mine in operating condition and the capital losses in idle equipment pile up so rapidly that profit and economy are better served by abandonment than by meager running time.

Ruthlessness in abandoning operations which experience has demonstrated do not fit into the Hanna organization set-up, however, is matched by an equally strong willingness to explore every avenue which may point the way to lower costs. This is exemplified in the mechanization program followed by the Hanna company. When, a few years ago, management was convinced that the only hope for large-scale profitable revival of the eastern Ohio area lay in the adoption of methods which successful rivals in competing districts had employed to bring down costs and increase the marketability of their product, Hanna did not hesitate to plunge into experimental work for the purpose of determining what methods would best suit the conditions in its field. Fairpoint No. 9—then closed down—was purchased and made the testing laboratory. And, as explained in detail in the articles on surface preparation and mechanization elsewhere in this issue, out of this experimentation has developed a program for further mechanization of underground loading and the installation of additional mechanical cleaning plants.

Along with the concentration in operating activities has come a simplification in corporate organization. In place of the half dozen separate operating companies as late as 1928, only one —the Hanna Coal Co. of Ohio—now functions. This company, a wholly owned subsidiary of the M. A. Hanna Co., was formerly known as the Wheeling & Lake Erie Coal Mining Co.; the change in name was made effective Dec. 16, 1931. All of the other mines of ten years ago—including the Dillon No. 2 mine, at Dillonvale; Dillon No. 5, at Flushing, and Dillon No. 7, at Neffs, of the Wheeling & Lake Erie Coal Mining Co.—have been either worked out, sold to non-affiliated interests or abandoned. As previously stated, in addition to the four mines now owned by the Hanna Coal Co. of Ohio, that company also operates the Piney Fork mines of the Jefferson Coal Co., which are treated as part of the Hanna organization in the articles which follow.

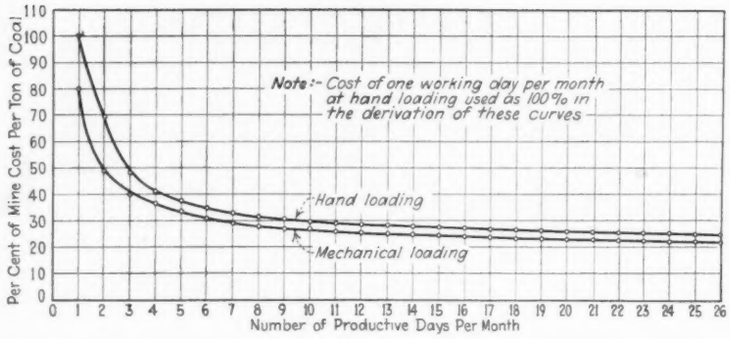

Per Cent of Mine Cost Per Ton of Coal
Note:- Cost of one working day per month at hand loading used as 100% in the derivation of these curves
Hand loading
Mechanical loading
Number of Productive Days Per Month

Fig. 2—How Bogey Costs Per Ton Decline With Increased Running Time.

Executive headquarters of the Hanna Coal Co. are maintained in Cleveland, Ohio, where the president and executive vice-president of the company have their offices. Operating headquarters, in charge of a vice-president and general manager of operations, are at St. Clairsville, Ohio, which is centrally located from the standpoint of actual operations, since two of the mines are within four miles of that city and the most distant are only 23 miles away. As shown in the organization chart (Fig. 1), the staff under the vice-president and general manager includes the chief mining engineer, preparation and testing manager, superintendent of machinery, safety director, manager of stores, manager of farms and the purchasing agent. All operating and corporate records are kept at the St. Clairsville office, which furnishes transcripts of essential control data to Cleveland headquarters.

While the organization set-up is the familiar combination of staff and line, in its actual functioning the line type predominates. Chief mine electricians, for example, report directly to the mine superintendent, but also send copies of their reports to the superintendent of machinery at St. Clairsville. Monthly inspection of the mines is made by the engineering department. Copies of these inspection reports, which point out both good and bad conditions and include recommendations as to the steps necessary to correct conditions criticized, go both to the mine superintendent and to the vice-president and general manager. The one outstanding exception to the tie-in between line and staff is in the operation of the company stores. These fall under the jurisdiction of a manager of stores who also is chief clerk to the vice-president and general manager, and reports of store operations and conditions do not go to a mine superintendent.

Planning of actual operations is controlled by two bogies—sales and operating costs. Sales quotas are made up in the first instance on a monthly and on a quarterly basis by the sales department in Cleveland. These estimates are subsequently revised and extended until a quota for the entire year has been set up. Estimates are made to cover the tonnage which the sales department expects to sell from each individual mine and the number of starts necessary to produce that tonnage are fixed. These estimates also include anticipated realizations. In addition to the breakdown by mines, the sales department estimates also break down anticipated sales by sizes for each mine and by major consumer classifications: viz., railroads, lake coal and commercial and retail

CONCENTRATION

Ten years ago, the Hanna interests operated 24 bituminous coal mines in Ohio, Pennsylvania and West Virginia. Ten of these operations were in the State of Ohio and had a daily capacity of approximately 8,400 tons per 8-hour shift, or 1,050 tons per hour.

Today the Hanna company is operating six mines in the eastern Ohio field with a daily output of approximately 8,700 tons per 7-hour shift, or 1,240 tons per hour.

These operations and their daily capacity per 7-hour shift are:

Dillonvale No. 1	700 tons
Lafferty No. 6	1,950 tons
Fairpoint No. 9	800 tons
Willow Grove No. 10	2,100 tons
Piney Fork No. 1	1,250 tons
Piney Fork No. 2	1,900 tons

Only two of this group—Dillonvale No. 1 and Lafferty No. 6—were part of the Hanna string in 1924. Fairpoint No. 9 was acquired five years ago, Willow Grove No. 10 was taken over this year; the Piney Fork mines are owned by the Jefferson Coal Co. and operated by Hanna.

dealer trade. The lake and commercial breakdowns are further refined to cover estimated quotas by sizes and the average anticipated realizations per ton.

Based upon these data, the operating department makes its estimates of production costs. As a starting point, cost bogies have been established for each mine on the basis of the pegged tonnage per start and 1 to 26 days' operation per month. The relation between the number of days operated and the cost per ton is shown in Fig. 2, which covers bogey costs at a typical hand-loading operation and at the Fairpoint mechanized operation. These bogies are subject to quarterly revision by the operating staff. Definite cost estimates for the tonnages set up by the sales quota are made and reasons for the variation, if any, between these estimates and the cost bogey, are explained.

At the end of each month, cost and tonnage statements are made up in the St. Clairsville office and copies are forwarded to Cleveland headquarters. These reports analyze costs in detail and also give the operating department's justification for any variation between the actual costs and the original estimates. Actual costs may rise because the tonnage shipped during the month was less than that estimated in the sales quota, or because of unusual expenses which could not reasonably be foreseen at the time the estimates were made. On the other hand, the actual costs may be less than the estimated figures because the sales department exceeded its quota. Generally speaking, however, the estimating is done so closely and against such a background of past experience and records that the difference between estimated and actual mine-cost figures seldom exceeds 3c. per ton.

Under the Hanna accounting system there are three major classifications of costs. The first is mine costs, which is based on tipple weights and covers direct labor and supply charges and direct supervision expenses. The mine cost statement (see Fig. 3) further breaks down labor costs to the passway by sections. The second classification—operating costs—is based on railroad weights; this classification includes the mine costs shown in Fig. 3 plus safety department costs, compensation insurance, additions and betterments expenses less any offsetting credits such as income from house rentals, stores, sales of house coal and miscellaneous supplies.

A recapitulation of mine and operating breaks down total mine labor and supply costs as follows: Labor—Passway, General Day Labor, Maintenance on Machinery and Field Office; Supplies—Passway, General Day Labor, Maintenance on Machinery, Field Office and Power. A supporting statement on maintenance costs shows total labor and supply costs for the maintenance of (1) pumps; (2) substations; (3) locomotives; (4) arcwall cutting and shearing machines; (5) drills, blowers and hoists; (6) loading machines; (7) pit-car loaders; (8) dryer at Fairpoint; (9) tipple. These totals are also reduced to a per ton basis. In addition, separate cost records are kept upon each specific piece of equipment.

Field office costs cover such items as mine office expenses, mining engineer-

Fig. 3—Detailed Monthly Cost Statement (Mine Costs); the Original Form Is 11x14¾ In.

HANNA COAL COMPANY

DETAILED COST STATEMENT FOR MONTH OF _____ 193__ _____ NO. ____ MINE

		SECTIONS										TOTAL
	Tonnage											
	Number of Days Worked											
	Average Tons Per Day											
	Average Number of Loaders											
	Average Weight Per Loader											
	Average Weight Per Group											
		LABOR—PASSWAY										TOTAL PASSWAY—LABOR		SUPPLIES—PASSWAY	
Acct. No.	DESCRIPTION	Per Ton	Per Ton	Per Ton	Per Ton	Per Ton	Per Ton	Per Ton	Per Ton	Per Ton	Per Ton	Amount	Per Ton	Amount	Per Ton
1	Cutting														
1	Loading														
1	Drilling, Shooting														
2	Yardage														
3	Falls and Deadwork														
	SUB—TOTAL														
4	Haulage														
5	Tracks														
6	Timbering														
7	Pumping, Drainage														
8	Ventilation														
9	Rerater Material														
10	Electric Circuits														
11	Supervision														
	Bonus														
	PASSWAY COST														

Acct. No.	DESCRIPTION	GENERAL DAY LABOR Amount	GENERAL DAY LABOR Per Ton	SUPPLIES—GENERAL Amount	SUPPLIES—GENERAL Per Ton
12	Main Line Haulage				
13	Road Maintenance				
14	Ventilation				
15	Pumping and Drainage				
16	Electric Circuits				
17	Tipple				
18	Maintenance Mine Cars				
19	Oils, Grease, Waste				
20	Preparation				
	Analytical				
21	Disposition of Rock				
22	General Outside				
23	Maintenance Gen'l Outside				
24	Sale of Scrap, Adjustments				
25	Supervision				
	General Day Labor Cost				

ing costs, employees' insurance, rental of the St. Clairsville office, telephone, telegrams, postage, stationery and supplies, auto maintenance, subscriptions and the cost of publishing *Hanna Coal News,* issued for free distribution among the Hanna employees. These field-office expenses are allocated to the six mines.

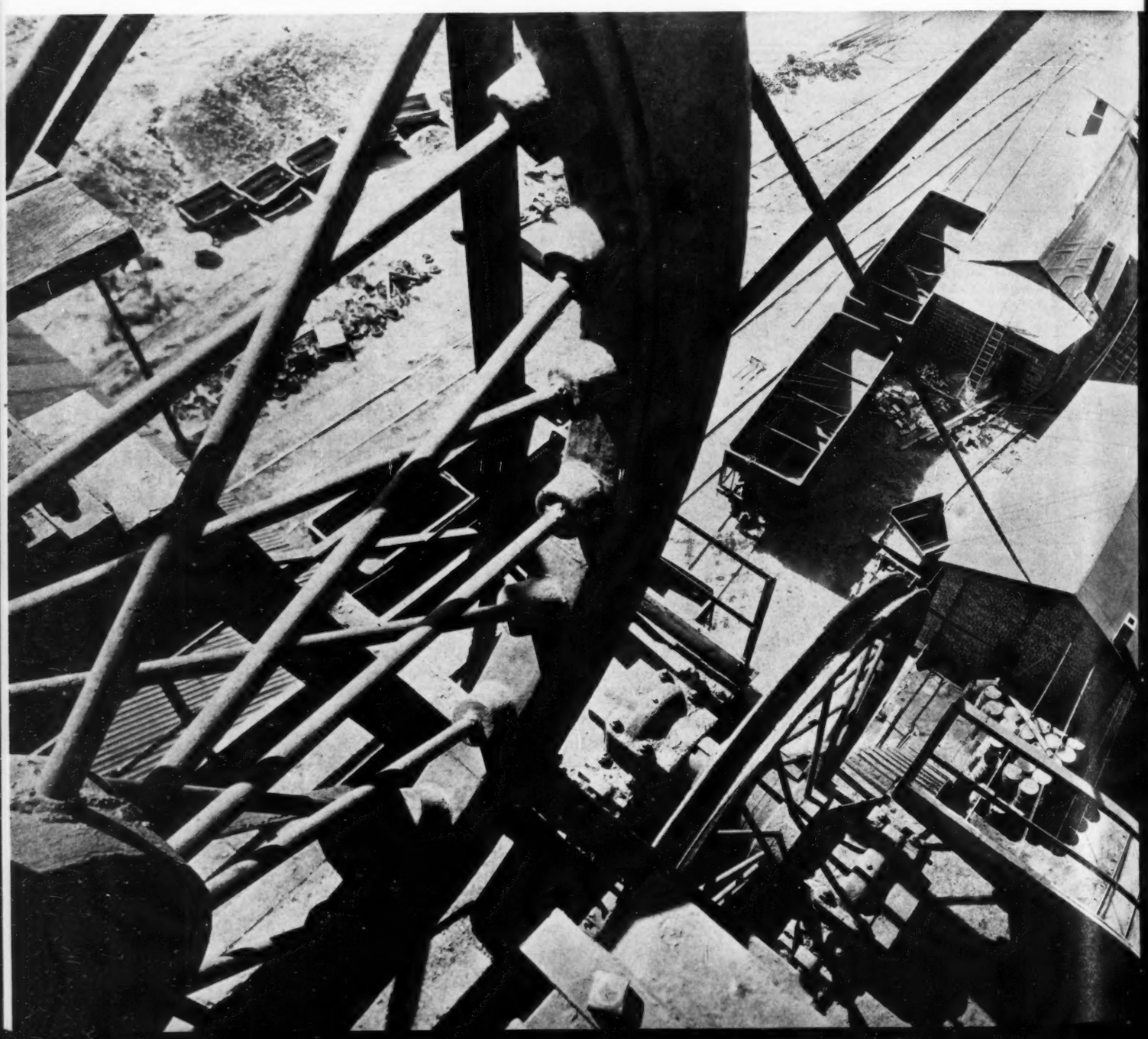
The final classification—total costs—includes the operating costs just outlined plus depreciation, depletion and royalties, sales commissions and fixed charges. The item of sales commissions arises from the fact that the Hanna Coal Co. of Ohio is a stockholder in Northern Coals, Inc., and pays that selling agency commission on all coal sold through the Hanna Coal Co. of Delaware, sub-agent for the Hanna Coal Co. of Ohio under the sales agency agreement. The major portion of this commission in turn accrues to the sub-agent.

As a specific instance of this closeness in estimating, results for August, 1934, furnish an outstanding example. On Aug. 4, the sales department estimated that it would be able to dispose of 229,797 tons; figures compiled Sept. 5 showed actual shipments of 223,054 tons for the month of August. The variations between estimates and actual performance by mines is set down in the table following:

	Estimated		Actual	
Mine	Tonnage	Starts	Tonnage	Starts
1	9,100	13	9,500	13
2	47,150	23	41,722	21
3	59,669	27	51,550	25
4	32,528	16	36,650	18
5	29,150	11	27,508	11½
6	52,200	18	56,124	19

Under a system in which operations are definitely forecast and under which the maintenance of excess mine capacity as a reserve against unanticipated upswings in demand is discouraged by the policy of eliminating mines which cannot count upon running 80 per cent of the time or more, development work cannot be left to chance without inviting costly grief. At Hanna, therefore, development work is forecast and planned as consistently as any other phase of the operations. This planning is on a quarterly basis. Where the work should be done, the character of the work and the date or dates when it should be completed are all subjects for advance decision. At the end of each quarter, mine maps are reposted to show how the development schedule has kept pace with the forecasts. As an aid to efficiency, an endeavor is made to maintain development crews intact regardless of how development work may be shifted from one part of the mine to another; moreover, specialization is carried one step further by keeping one group of men on wide work and another group on narrow work.

Looking Down From the Headframe of the Lafferty Shaft.



MINING METHODS

+ At Hanna Coal Co.

UNUSUAL room-and-pillar methods of mining have been adopted at mines of the Hanna Coal Co. Instead of starting rooms one by one from the butt heading and letting the progress of one room trail behind the progress of the next, as is the usual method, eighteen rooms are started at the same time and go forward as nearly as possible together, so that they finish concurrently. At the same time, eighteen other rooms are started on the opposite side of the entry out of the parallel heading, and these run their course in the opposite direction and also finish at approximately the same time. The pillars are 6 ft. through and are not drawn.

Each of the groups of eighteen rooms are in sub-groups of nine, separated by a panel pillar of width equal to a room width plus two pillar widths. Where room is available, and it is generally provided, two groups, each of eighteen rooms, are driven from each of the two headings in the entry, with a separating pillar of the size stated between the two adjacent groups. A group of eighteen rooms on each side of the entry, or 36 rooms in all, constitute a "unit," and one unit is completed before the other is started.

The inbye unit is mined first and the outbye unit later, the coal from the inbye unit being hauled in cars to an inbye face heading, and the outbye groups to an outbye heading. When the units are finished, no pillars are drawn either in the rooms or in the headings, except at Piney Fork No. 2, which is nearly finished. The roof then is allowed to fall. Occasionally it is necessary to place the face entries at a greater distance apart than indicated, and in that case one of the sub-groups may contain more rooms. Then the room entry will be fortified in the center of the enlarged sub-groups by arranging that one room on each side of the entry shall not open on the heading but shall start from a crosscut driven between adjacent rooms—that is, the center room of the sub-group is a "blind room" without direct communication with the heading, leaving a pillar of somewhat irregular shape but 34 or 36x50 ft. in general dimension.

Rooms where coal is undermined by an Oldroyd machine standing on the track are made 22 ft. wide, and where a shortwall machine is used to cut the underkerf they are made 24 ft. wide. In all cases the room pillars are, as stated, 6 ft. through, and the rooms are 250 ft. long. Eventually, the rooms from adjacent entries meet end to end, the coal being completely removed where the rooms join. The only coal left in the rooms is pillar coal. On either flank of the two groups of rooms in each heading a solid barrier pillar, 200 ft. wide and 500 ft. long, is left for removal on the final retreat, and in the extraction of this pillar, rooms 200 ft. long are driven concurrently from the face entry and parallel to the room headings, so as to remove the greater part of both the barrier pillars at the same time, if there is such a pillar under good roof on each side. The barriers at Dillonvale mine—an old and nearly finished operation—are only 150 ft. wide. They are removed by methods similar to those used in the advance operation, driving, however, sometimes as many as 34 at one time on each side, so as to provide a sufficient tonnage to justify operation.

Entries consist of two headings side by side and at 32-ft. centers, the rock and parting material being hauled to the surface and dumped on the rockpile. Cover ranges from nothing to 350 ft. Usually, the cover is much less than the latter figure. All rooms and headings are driven on sights. It is found that in the rooms driven with track-mounted machines the pillar between rooms is invariably of the required width, because the machine, being on the track and the track being properly located with its center line on the sights, cannot swerve from the right direction. Experience has shown that rooms can be extended the full 250 ft. without difficulty. If provision is made for any greater length, it may be expensive, or even dangerous, to extend them the projected distance.

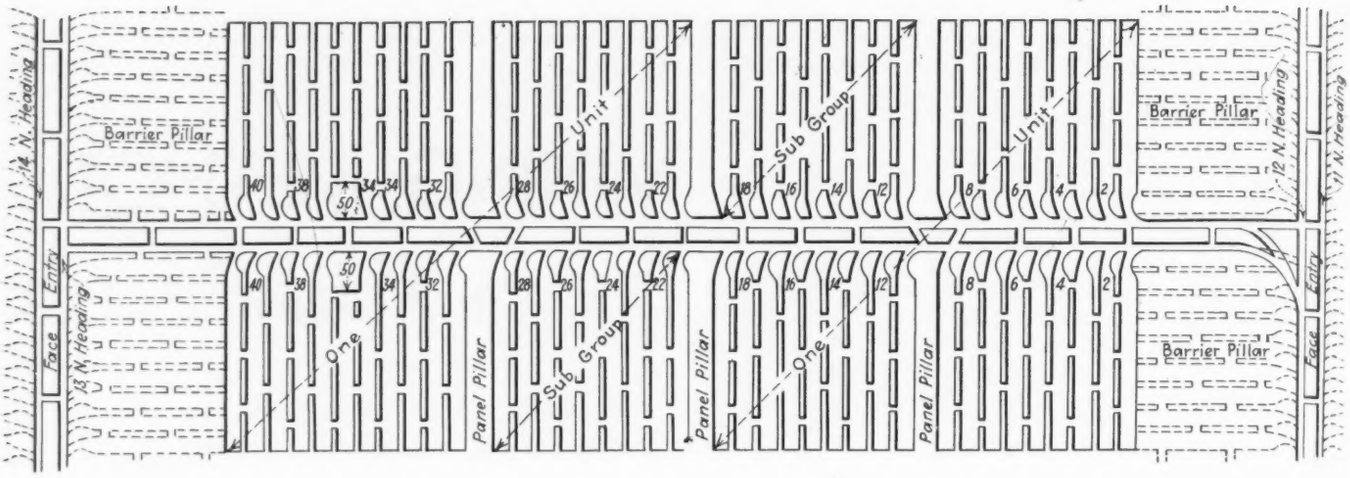
Eight-foot crosscuts are driven through the pillars between alternate pairs of rooms at 40 ft. of distance, and then again on the opposite side of the room after the face has advanced another 40 ft. This practice is continued until the rooms are finished. The panel pillars between the nine-room sub-group and the eighteen-room groups are not crosscutted and not withdrawn. Roadways are laid exactly in the center of the room, which latter attains its full width about 50 ft. from the heading from which it is started.

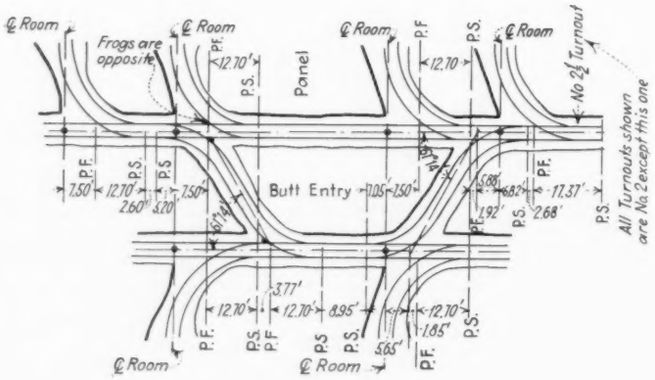
Though, under this method, only about 60 per cent of the coal is removed, so much roof rock and parting rock are gobbed in the room—for none is taken outside from the wide or room work—that it is thought probable that some time in the remote future it will be possible to enter the mine again and remove the standing pillars, because the work has been so regular and because the gobbed rock will supply enough roof support to make such entrance readily feasible, though the coal will be crushed. By that time, probably, demand will be lacking for lump coal, for all fires, domestic as well as industrial, will be stoker-fed.

Face headings usually have a 200-ft. barrier on either side, which gives abundant protection. Sometimes, however, there may be an outcrop a short distance from one side of the face entry, in which case the cover is light, and sometimes there may be workings from another mine, but in this case a barrier will be provided so as to prevent pressure being imposed on the workings that are being extended. All the mines have drifted entries except No. 6, at Lafferty, which is a mine with a 107½-ft. shaft, and No. 10, at Willow Grove, that has a slope by which the coal is lifted to the surface.

When a hand-loading mine is double-shifted the rooms are worked for a single shift only, different sections of the mine being operated in one shift from those in the opposing shift. Each working place is manned by two men and each pair of men has two places, so the progress of the face, though rapid, is not as speedy in the hand-loading places as double-shifting would indicate.

By driving all the rooms in each unit at one time, the most favorable conditions are obtained for intensive, or concentrated, mining. The work is not scattered, and when a unit is completed the work suddenly shifts to another, the necessary room necks having already been driven, rails laid and sights set. In





Above, at Right, Method of Driving Rooms in Groups of Eighteen on Each Side of Butt Heading. On Left Are Groups of Twenty Rooms With a Large Pillar Left in Center of Sub-Group of Eleven Rooms to Afford Additional Strength.

consequence there is no upkeep in the operating units after they are abandoned. Track is drawn out and the roof is allowed to fall.

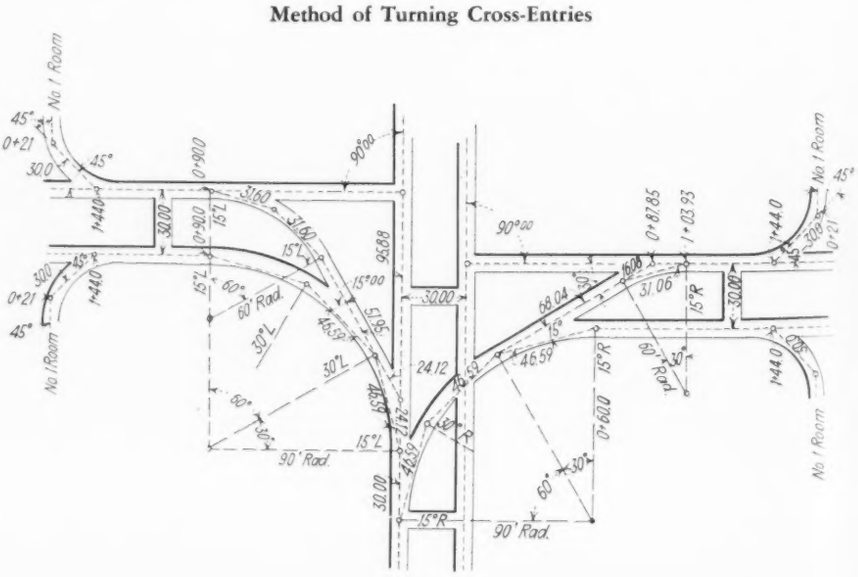
In the machine mine, No. 9, at Fairpoint, the room entries have three headings, and there, as described in the article on mechanical mining, the system is entirely different. In the No. 10 mine, at Willow Grove, is a section that has a long way to travel and a large area to be extracted. Here a four-heading face entry is being driven, as described in the article on ventilation. Here the heading centers are 32 ft. apart, and the center pillar is solid with breaks only where entries are driven to the right or left.

For the protection of the roof, which is adversely affected by the moisture of the entering air, especially in the summer months, the roof is gunited in places at the Lafferty and Willow Grove mines. At Lafferty is an old slope down which timber and other supplies are lowered into the mine. It has an inclination of 22 deg. and is 200 ft. long. When the mine was purchased by the Hanna interests it had caved until it was quite high and appeared likely to continue to fall. The roof was scaled down until solid material was reached. This solid rock was in layers, and in consequence the roof of the slope is not straight but stepped, being level for a few feet and then stepped down to the level of the underside of another layer of rock. After careful scaling, it was gunited in layers to a depth of 2 in. On one side of the slope is a concrete stairway, over which is suspended the power line entering the mine.

The entire slope is gunited as well as 50 ft. of gangway beyond. The bottom had a retaining wall of concrete block, and this, with the roof above it, has been covered with 2 in. of gunite for a length of 350 ft. The slope roof was reinforced with heavy wire mesh for the first 50 ft. and such reinforcement has been used elsewhere wherever there has been any indication that trouble might arise from water, which, held back by the gunite, might be expected to develop hydraulic pressure. To provide the requisite compressed air, an Ingersoll-Rand No. 14 portable compressor was provided.

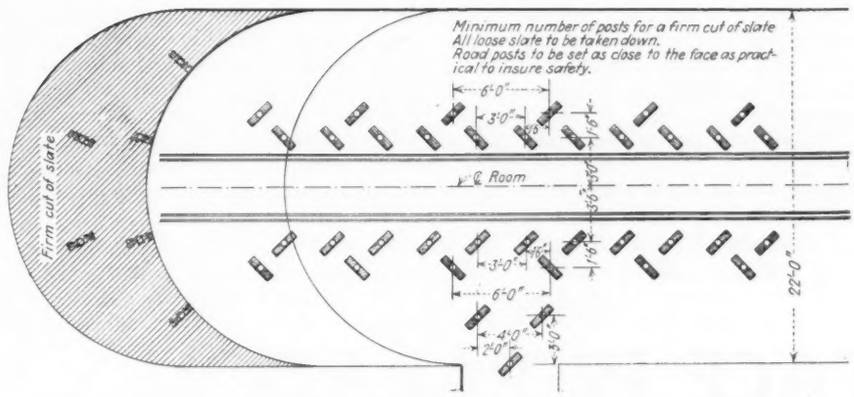
At Willow Grove mine, two of the headings in the bottom have been gunited for a distance of 2,000 ft., and the main haulageway for a distance of 1,000 ft. More guniting is proposed. The heading from the fan to the main heading will certainly be gunited for a distance of 1,000 ft., for this will carry raw surface air that in the summer will be full of moisture freed by the cooling of the air and, in minor degree, by its compression. Probably the entire main haulage will be gunited eventually, because that roadway has a long period of service before it, and the work will be well justified by the tonnage that will have to be transported through it. What work has already been done was necessitated by the

Method of Turning Cross-Entries



condition of the haulageway which caused it to need either guniting or timbering. As the first could be as cheaply performed as the second and promised a far longer life, the haulageway was thus treated. All the guniting is 1 in. thick. Gunite also lines the airshafts. Here the coating is 3 in. thick and reinforced with wire mesh. An inside substation at Willow Grove also is covered with 2 to 3 in. of gunite with No. 10 3x3-in. reinforcing mesh, securely anchored by expansion bolts. Thus far it has held up well. The 2,010 ft. 12-in. trench in which the 4,000-volt a.c. cable is installed at the Willow Grove mine was covered wherever water was encountered with 2 in. of gunite, and after the cable and telephone wires were laid, the trench, cable and wires were covered with 3 in. of gunite.

A trial section of Truscon steel timbering 20 ft. long has been provided to hold the roof in the Fairpoint mine. The dished plates are bolted together to form an arch of 4½-ft. radius. They are holding the roof satisfactorily.


Minimum number of posts for a firm cut of slate
All loose slate to be taken down.
Road posts to be set as close to the face as practical to insure safety.
Firm cut of slate
℄ Room
6'-0"
3'-0"
22'-0"

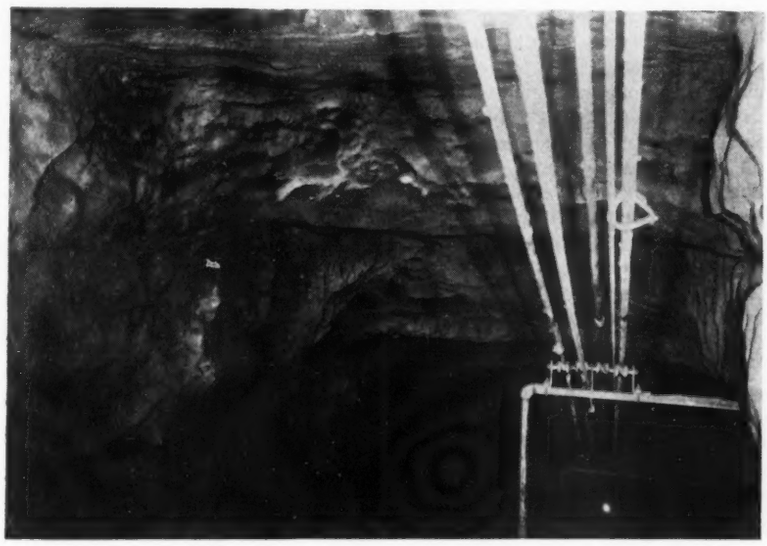
How Roof is Supported in Rooms by Permanent and Safety Posts.

In many places the Hanna company has used I-beams as cross timbers to support the roof measures over the roadway. Dillonvale mine is being retreated, and opportunity is obtained there to learn to what extent such material can be recovered. Dillonvale manages to draw about 50 per cent of these supports.

As the rock over the coal is treacherous, much attention has been given to timbering. Six safety posts are used under the drawslate in all hand-loading operations before it is taken down, and this unusual practice accounts for the low fatality and accident rate in handling the drawslate. Care also to remove all this uncertain rock has much to do with the safety enjoyed by all men employed in face operations. Miners drilling the rock are cautioned to see that none of their holes is permitted to enter the roof coal on which the safety of the working place depends.

The more permanent room timbering also is somewhat unusual, most of the props being placed where they will support the roof over the roadway, whereas the practice at most mines is to spot them evenly over the width of the room except where a wide space has to be left to accommodate the track. The Hanna method puts the posts where the load is greatest, the roof most likely to break and where the support is most needed for the protection of the men employed. "Road posts" in rooms are set at 3-ft. centers, or closer if need be, along the road on either side and centered 3 ft. 6 in. from the center line of the track. Back of these at 6-ft. centers, 1 ft. 6 in. from the road posts, is set on each side of the track a line of posts, each of which is staggered with every alternate pair of road posts. Three additional posts are set opposite each crosscut, one in the center of the crosscut and along the rib line, and two 3 ft. from the rib, one of which is 2 ft. beyond, and one 2 ft. outbye, the center line of the crosscut.

As the bottom, though of fireclay, is reasonably hard, no foot-pieces are used. The downward movement of the roof has not been sufficient to require the pointing of props; in fact, as all are 4½ in. in diameter at their smaller end, they are



Looking Down Lafferty Slope—Roof Scaled Down in Steps and Gunited.

Roadway Roofed by Bolted Plates Forming Segmental Arch.

enabled to hold the load without much bending and without bedding themselves in the clay. Under the clay, which is about 14 in. thick, is a bed of hard limestone.

The outstanding features of the Hanna operations are intensive mining, driving of groups of rooms concurrently; use of unusually thin room ribs, which are left in with larger pillars at intervals; unusually big barrier pillars and thin heading ribs; no recovery of the latter but recovery of barrier pillars on retreat, these pillars furnishing enough tonnage to make retreating operation as profitable as, or more than, advancing operation.

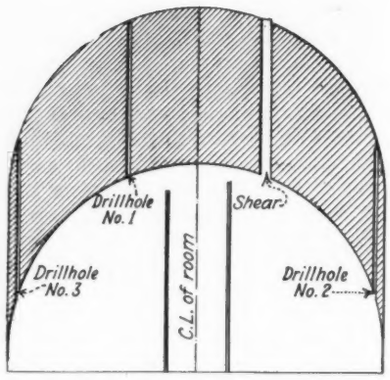


Fig. 2 — Standard Blasting Practice With Side-Sheared Rooms.

FACE PREPARATION

+ At Hanna Coal Co.

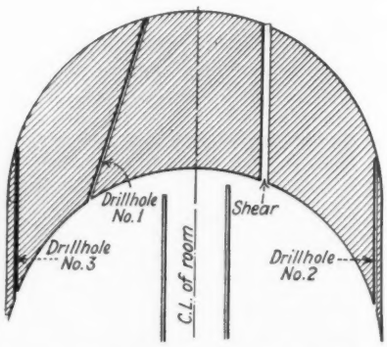


Fig. 3—Shooting Method Favored at Willow Grove No. 10.

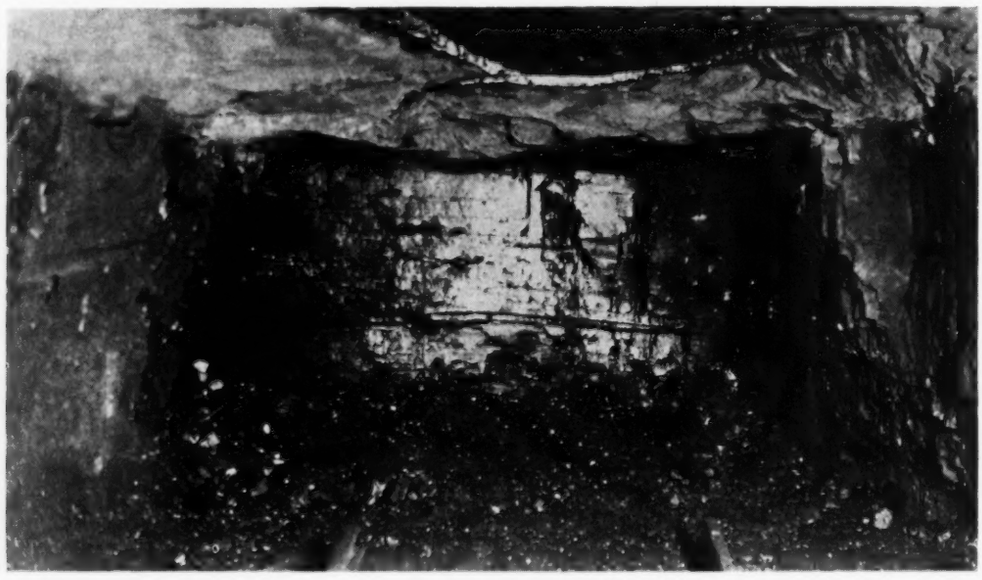
AT THE MINES of the Hanna Coal Co., shortwalls are being superseded by track-mounted machines, and careful studies are being made of methods that will increase the size of the coal loaded and still further improve its quality. The coal contains three bands which are removed at the point of loading in hand-loading mines, and at mechanical loading mines are separated by hand-picking and washing.

The seam mined is the Pittsburgh, known in Ohio as the No. 8 seam. It is covered with from 8 to 18 in. of shaly slate, which is a whitish rock, free of oil or coal and known locally as "stone." Above this is a roof coal which may be 2 ft. thick, but is often much thinner and sometimes entirely disappears. If roof coal is present and is supported by props, no trouble is experienced with the roof. Should it break through, however, or should it prove weak or entirely absent, there are all kinds of trouble, for the roof above the roof coal is as treacherous and uncertain as that below it and, once it begins to break, it falls until the limestone above it is reached. The stone on which the roof coal rests and that above the roof coal contain much lime, but these rocks are so mixed with shaly material that they have no strength. These conditions are typical of the No. 8 seam of Ohio.

Three benches of clean coal are found in the seam. The top one is the most blocky and is about 23 in. thick, being covered by 2 in. of bone. Under it is the middle band or parting, 3½ in. thick, and the middle bench of coal, which averages 20 in. in thickness. Under this again is a 1-in. parting and a bottom bench of coal, 12 in. thick, making the entire seam 5 ft. 1½ in. thick. In hand mining, these partings are picked out and thrown in the gob. At Fairpoint they are loaded by the machines for removal on picking tables and in the mechanical cleaning plant.

Dillonvale mine formerly used Oldroyd track-mounted machines, but, as it is now on retreat, it is using three Goodman 50-hp. 12 AA cutting machines with a 6-ft. cutter-bar and a 24-in. feed. Piney Fork No. 1 has five

Fig. 1—Face of Heading With Square Face Showing "Stone" and Roof Coal.



Oldroyd 40-hp. Model D, Type B2, cutting machines and one Goodman 12 AA machine. Piney Fork No. 2 utilizes one 12 AA Goodman, nine 12 DA Goodman, one 12 A Goodman and eight Goodman 112 DA Universal machines. Lafferty has five Oldroyd 40-hp. Model D, Type B2, cutting machines with a 9-ft. cutter-bar and two Goodman 50-hp. 112 AA undercutters with a 6-ft. cutter-bar. Fairpoint is equipped with six Oldroyd 40-hp. Model D, Type B2 cutting machines with a 9-ft. cutter-bar, and Willow Grove has six Oldroyd cutters of the same type.

Wherever shortwall machines are operated the miners drill their own shotholes and fire them, using pellet powder and squibs. At Fairpoint, where Oldroyds are used, the face is drilled and shot by shotfirers with pellet powder electrically ignited. At Piney Fork No. 1 there are four Chicago Pneumatic electric coal drills, and at Willow Grove two Chicago Pneumatics and two Jeffreys. Definite standards have been set both for shots after shortwall undercutters, and for the shotfirers who follow the Oldroyd machines. These standards are now in process of study and may be modified where conditions seem to favor such modification.

Oldroyd machines cut not only an undercut but a vertical kerf about 2 ft. to the right of the room center, which is the limit of its range for such a cutting. A drillhole, No. 1, is drilled 4 ft. to the left of the center near the top of the coal so as not to penetrate the bone coal. Holes are drilled near the ribs on either side. These holes are not loaded or tamped until the center hole has been fired. None of the holes must be drilled to a distance exceeding the depth of the undercut. The charge of these holes is determined by the resistance of the coal, but every effort is made to bring down the face with a minimum of disintegration. The two side holes are fired separately. Before firing any shots, bug dust is removed from the undercut as thoroughly as possible.

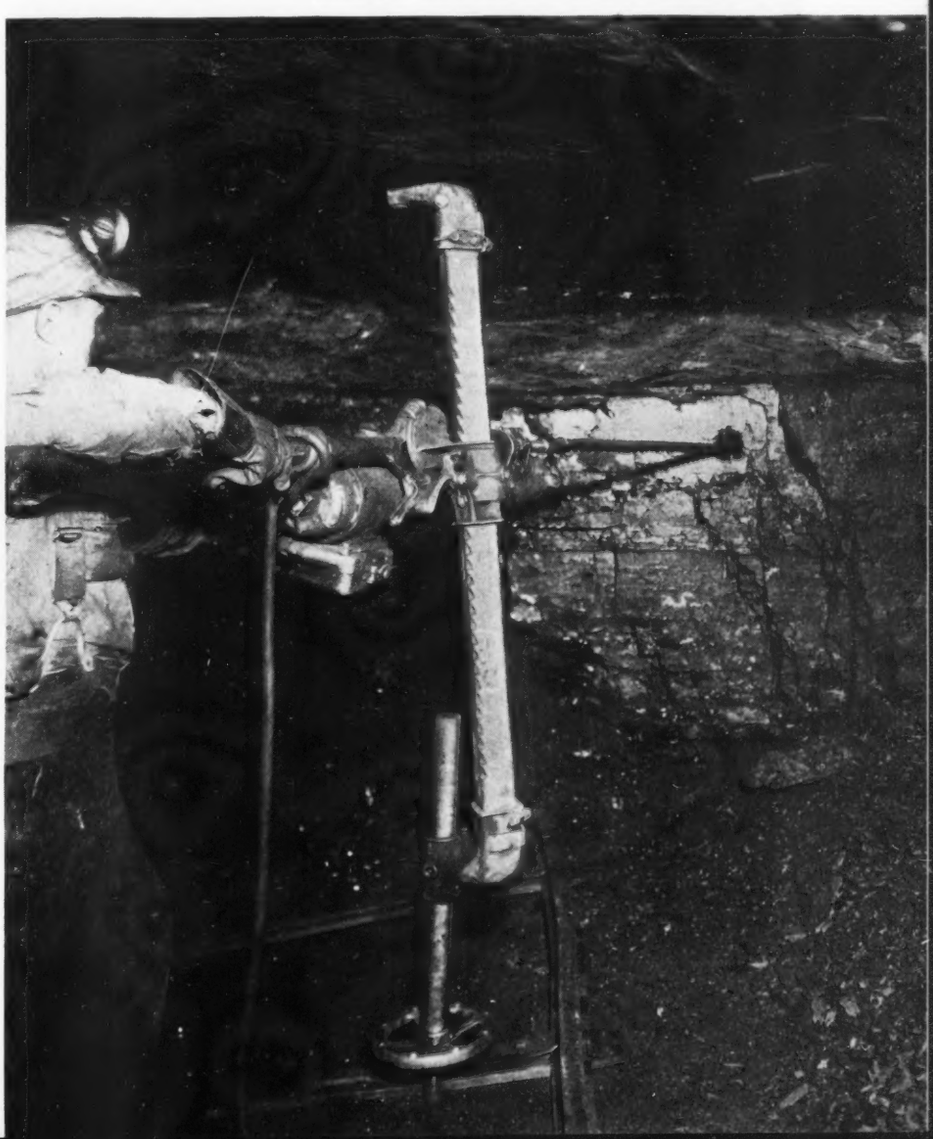
However, at Willow Grove, with hand-loading, it has been found desirable to place the more central drillhole so that it will run at an angle to the rib line, and in such manner that it will be nearer the shear cut at the back than at the face of the coal. The tendency of such an oblique hole is to shoot the coal away from the face instead of moving it toward the shear cut. At Fairpoint, where the coal is loaded by machine, the coal usually is sheared in the center and two holes are drilled diagonally on each side of the shear cut, in such manner that they will be further away from the shear kerf at the back of the cut than at the face. This again tends to throw the face out. It has been found that these changes have made it possible to reduce the charge, as well as produce more large coal and less slurry (coal which will pass a ½-mm. wedge-wire screen), bringing down the coal in better condition for loading. The object of the experiments now being made by a master shooter is to produce more lumpy coal and, at the Fairpoint mine, to increase production —for fine coal cuts down the capacity of the preparation plant—also to reduce the percentage of slurry.

A uniform standard for shooting cannot be maintained with advantage, for some of the coal requires heavier blasting than other coal, due to the presence of "black jack"—a cannelly coal which resists blasting. In fact, it probably will be found that different charges and a different disposition of the kerf cut and drillholes will have to be used in different sections of each mine, so greatly does the resistance vary from section to section.

In the hand-loading mines, where one Oldroyd is appointed to each unit of 36 places, it does not cut all these in a single shift, but can be relied on to cut such faces in that unit as have been prepared for that service.

Wherever track-mounted machines are used in hand-loading, four or more safety props are set under the outer edge of the roof stone as fast as the cut is loaded out. These props have standard cap pieces, 2x6x18 in., set with their long dimension radial to the curve of the face. Two other safety props with standard caps are set at a mid-distance between the face of the coal and the front line of safety props, making six safety props in all. All props must be set as soon as access to the location where they are to be set is cleared of coal. When the coal is loaded out clean, these props are knocked out and withdrawn, beginning at the two inbye props first, and if the stone does not fall, the requisite holes are drilled in it and the roof stone is shot down, the placing of the holes being regulated by conditions, for some of the stone may be loose and fall, some may be susceptible to barring and some may have to be shot. The stone that needs barring is never brought down with picks, because men endeavoring to dislodge the stone in this manner might overbalance in pressing down on the suddenly yielding mass and fall under it, or might station themselves so close to it that when it fell it might drop on them. No safety posts are put under the stone at Fairpoint, where the coal is loaded by machine, as only the machine is compelled to go beneath the stone in cleaning up the face.

Drilling Practice at Hanna Mines.



WHO'S WHO

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Safety Director

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Preparation Manager

F. C. KETTRING
Assistant Secretary-Treasurer

JOHN H. RICHARDS
Chief Mining Engineer

J. A. RALSTON
Manager of Stores

BERT SIMONSON
Superintendent of Machinery

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IN HANNA ·II·

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Superintendent
Willow Grove No. 10 Mine

WILLIAM WHELAN
Superintendent
Piney Fork Nos. 1 and 2 Mines

HUGH BOYLE
Superintendent
Dillonvale No. 1 Mine

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Purchasing Agent

TAYLOR E. ROY
Superintendent
Fairpoint No. 9 Mine

H. V. REUSSWIG
Superintendent
Lafferty No. 6 Mine

E. T. ARNOLD
Superintendent of Farms

MECHANICAL LOADING

+ At Hanna Coal Co.

PROGRESSIVE transformation from a high-cost hand-loading mine to a low-cost completely mechanized operation since May, 1929, sums up the experience record at the Fairpoint No. 9 plant of the Hanna Coal Co. With concrete evidence of the possibilities of mechanically mining and cleaning the Pittsburgh No. 8 seam of eastern Ohio —where natural conditions are none too good—as a guide, similar installations are scheduled for additional Hanna operations where remaining life and other conditions are favorable.

As successful mechanical loading necessarily would require loading the entire seam, including impurity bands and a certain portion of the drawslate top, the first step in the Fairpoint program was the installation of a mechanical cleaning plant (p. 469). A contract for the washing equipment for a second plant at another Hanna operation has been let, and equipment now at Fairpoint will be moved to still another operation within the next two years—the probable maximum life of the mine at the present rate of extraction.

Duckbill conveyors (*Coal Age*, Vol. 35, p. 227) were the first machines to be introduced in Fairpoint, primarily for driving entries. Installation of track-mounted mobile loaders in rooms (*Coal Age*, Vol. 36, p. 171) was started in 1930, and in entries (*Coal Age*, Vol. 37, p. 95) in 1931. Revision of equipment also was extended to cutters, existing shortwall machines being replaced by track-mounted cutting and shearing equipment.

With mechanical loading and cleaning results meeting expectations, the next step was an investigation of the possible effect of a larger car on loader performance, which resulted in the replacement of the old 2-ton car with 4.5-ton Differential side-dump units (p. 466), beginning in August, 1931. Increasing demand for coal, plus the favorable cost and preparation record, resulted in a change to double-shifting in the same month. In May, 1934, the plant went on the triple-shift basis.

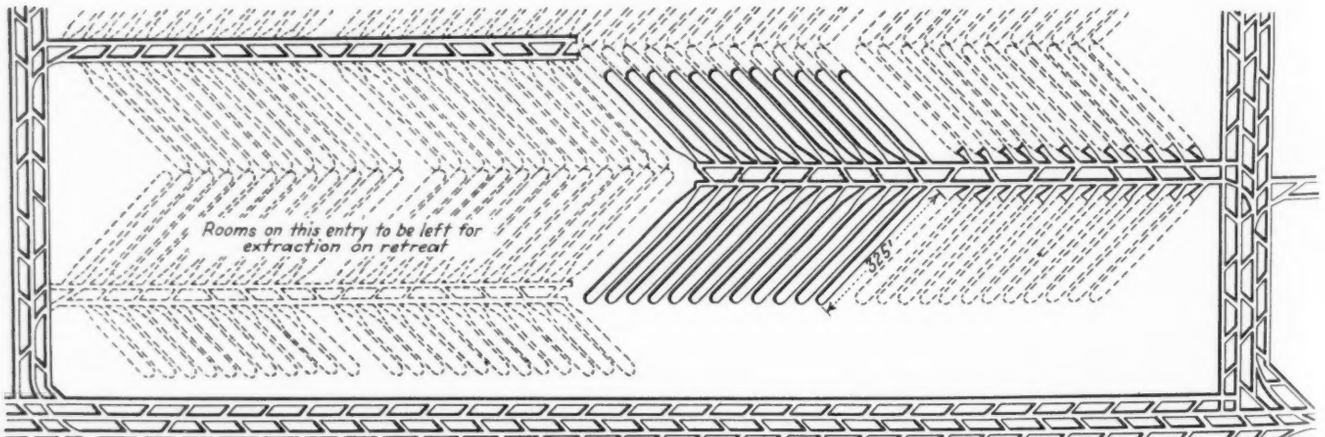
Except for an occasional roll, the coal at Fairpoint lies fairly level. Thickness rarely exceeds 5 ft.; and the cover varies from the outcrop to 250 ft. The immediate roof consists of drawslate 1 ft. or more in thickness, which must be taken down after each cut. Entry work is based on loading the slate for disposal on the surface. In rooms, however, it is piled along each rib. Even after the slate is taken down, close timbering is required to protect the next higher roof series, consisting of 0 to 18 in. of roof coal, which is left in place, and 6 to 8 ft. of shale. Roof conditions, including, as they do, relatively little cover and hard, massive limestone strata in combination with easily broken softer materials, prevent the extraction of pillars.

When mobile loaders were first introduced at Fairpoint, the complete 90-deg. system of turning rooms and entries was continued for a time, but later was abandoned in favor of the present 45-deg. layout, in which room entries are turned at an angle of 45 deg. to the face (cross) or main entries, as the case may be, after which the rooms also are turned at an angle of 45 deg. This system was adopted to facilitate the movement of equipment into and out of working places.

At future mechanical-loading mines, however, the system shown in Fig. 1 will be installed. In this case, room entries will be turned at right angles, but the 45-deg. rooms will be retained, as indicated. Fig. 1 also shows the method of dovetailing entries so that the triangular blocks necessary with such a mining plan will occur only on the entries.

Rooms are laid out in panels of twelve, which experience at Fairpoint has shown to be the most efficient grouping for maximum coordination of loading, cutting, drilling, tracklaying, timbering, handling of drawslate and other necessary activities. Four such panels will comprise a standard room entry in future work, the inbye panels

Fig. 1—Standard Plan of Mining to Be Used at New Mechanized Operations.



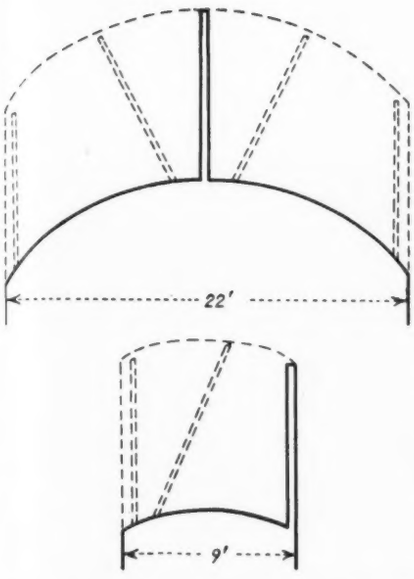


Fig. 2—Placement of Shear Cut and Shot-holes in Rooms (Top View) and Entries (Bottom View).

being worked out first, after which the outbye panels are mined. All twelve rooms at Fairpoint, the same applying to future installations, are advanced together to the maximum depth of 325 ft. Room centers are 30 ft. and width is 22 ft., the maximum which can be cut by the track-mounted machines with a 9-ft. cutter bar. Room-block barriers, made by skipping a room, are left between each pair of panels to minimize the possibility of the roof riding over from a worked-out panel to the one being mined. Room necks, as a rule, are left until the entry has been driven up, the loading machine then undertaking this task.

Four loading machines are in use three shifts per day at Fairpoint. Two are employed in driving entries and two in working rooms. A fifth machine works two shifts in wide work, and a sixth is kept as a spare. Each loader is part of a unit working entirely within a section—room panel or entry. In wide work, or rooms, the Fairpoint unit, which will serve as a model for future installations, consists of one loader (Whaley "Automat," No. 3 size), one track-mounted cutting and shearing machine (Oldroyd), one post-mounted electric coal drill (Chicago Pneumatic or Jeffrey) with truck, one portable electric slate drill (Chicago Pneumatic) with truck, and one gathering locomotive (Goodman 5-ton or Jeffrey 6-ton).

Seventeen men comprise the crew for the unit as outlined above, a reduction of one from the number originally employed. Table I shows the number of men assigned to each activity and Fig. 3 the distribution of the crew and equipment throughout a 12-room panel.

Assuming the coal to have been loaded out, the cycle of operations in a room begins with the stone drillers and shooters, who also extend the lines of permanent posts. Holes are drilled in the slate as close to the roof coal as possible, the number required per cut varying from none where, as occasionally is the case, the slate comes down while the coal is being loaded, to as many as eight where the material is difficult to break. The average, however, is four. Two rows of posts (and as many more as may be necessary) are carried on each side of the track, as shown in Fig. 8, and these are extended by the slate drilling and shooting crew. Additional safety posts are set by the loading crew as the cut is loaded out. In no case, however, is the loading crew required to go under the slate, as the loading head is long enough to allow them to reach the back of the cut from their station under the coal roof.

Slate shot down is then broken up and gobbed, and the place cleaned up by the slate cleaners, who are followed up by the cutting machine and crew, which cuts and shears the place from the track as laid for loading the previous cut. Extending the track and drilling the coal are the next two tasks, men employed in these activities generally working together.

Rooms, as shown in Fig. 2, are sheared near the center and shot with four holes. These holes require three drill set-ups (one for each rib and the third for the center holes), and are located about 8 in. down from the top to prevent breaking the slate, with consequent admixture into the coal. Bug dust is removed from the kerf by the drill helper while the holes are being put in. The final step consists of loading the holes with "Blakstix" pellet powder and shooting down the cut. The drillers and shooters are followed up by a preparation man, who removes any slate that may have come down with the cut and shovels up any scattered coal ready for the loader.

Where possible, the main-haulage locomotive sets empty trips into a room close to the loader. Four cars at a time are taken by the service locomotive to the machine, and as each is loaded it is spotted on the entry or in an adjacent room to cut down the distance traveled in making a change.

Entry units at Fairpoint are substantially similar to room units, and include

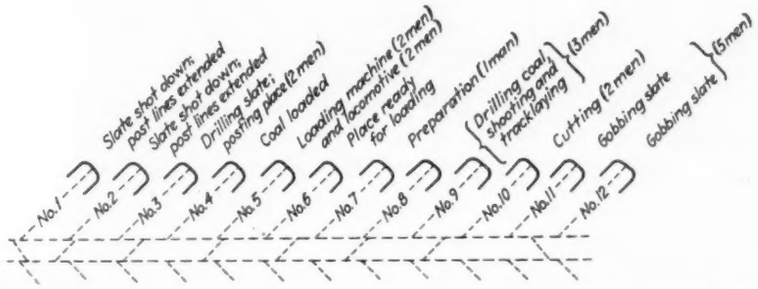


Fig. 3—Operating Cycle With Mechanical Loading Unit in Twelve-Room Panel.

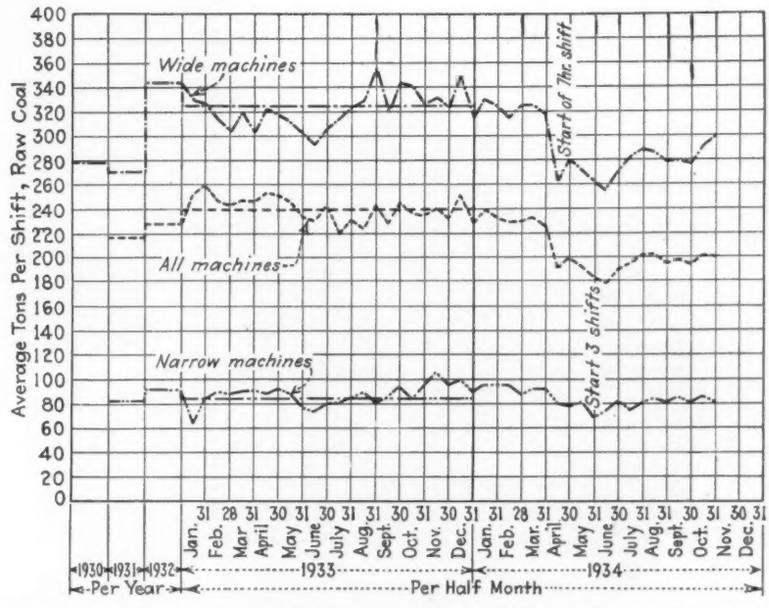


Fig. 4—Average Loading Machine Output Per Shift at Fairpoint Since the Start of the Mechanization Program.

Fig. 5—Starting a Cut in a 22-Ft. Room at Fairpoint After the Slate Has Been Shot Down and Loaded and the Rows of Posts Have Been Extended.

Fig. 6—Drilling and Bug-dusting in Preparation for Shooting Down the Cut.

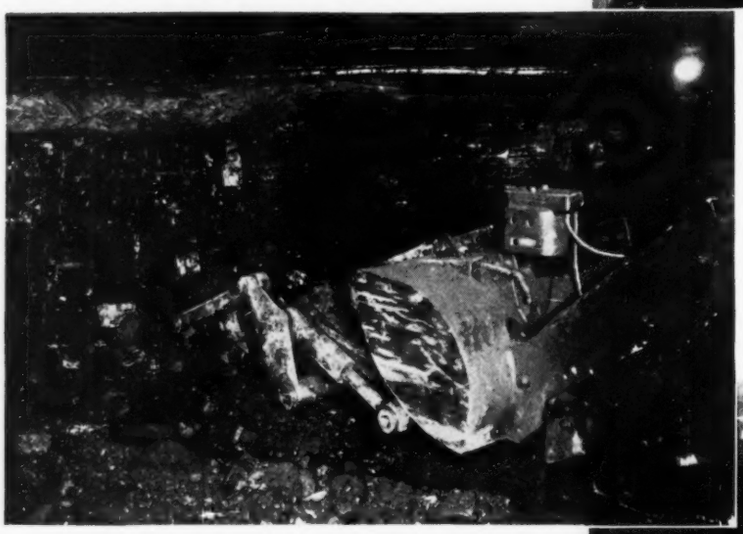


Fig. 7—Loader Working in One Corner of the Place (Note Drawslate Above the Coal).

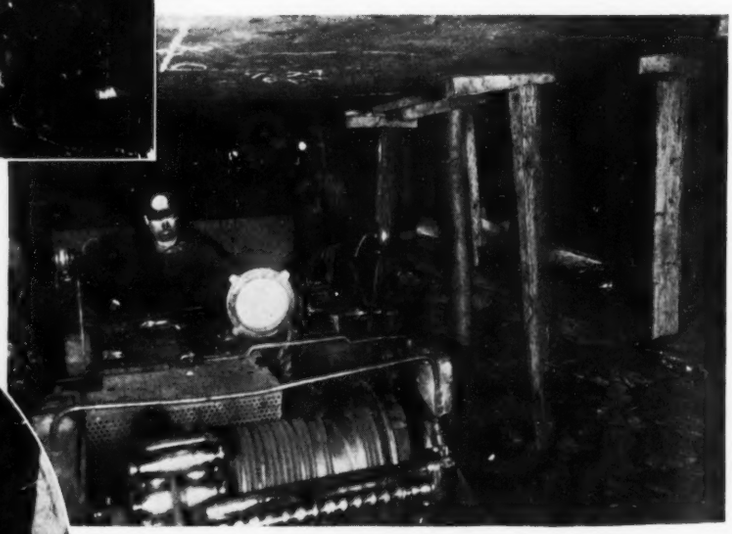


Fig. 8—Drawslate Is Gobbed Along Both Sides of the Track, Which Is Placed in the Center With Two Rows of Posts on Each Side.

Fig. 9—Place With Track Extended and Ready for Loading.

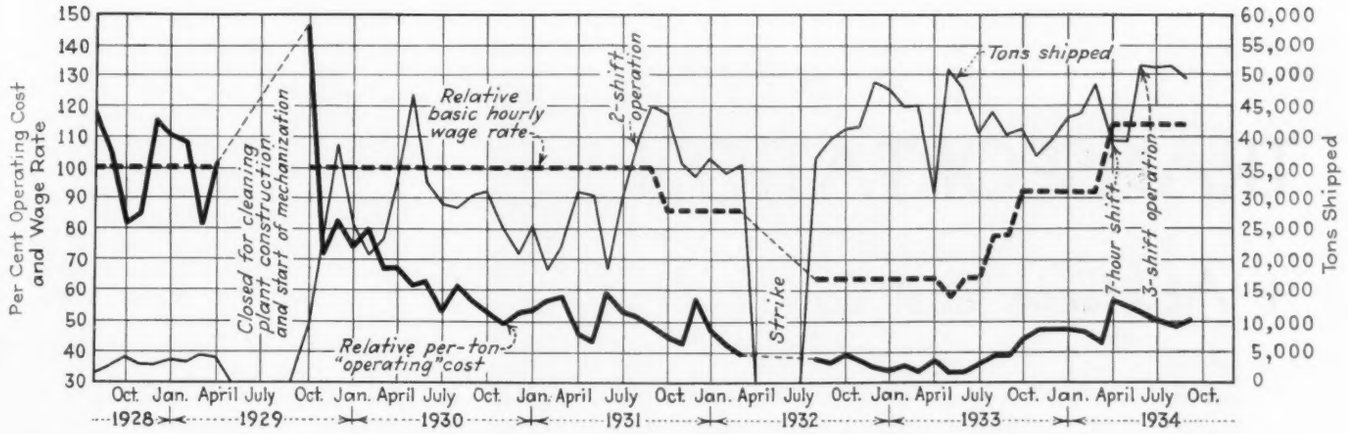

Per Cent Operating Cost and Wage Rate
Tons Shipped
Relative basic hourly wage rate
Relative per-ton "operating" cost
Closed for cleaning plant construction and start of mechanization
2-shift operation
Strike
Tons shipped
7-hour shift
3-shift operation
Oct. Jan. April July Oct. Jan. April July Oct. Jan. April July Oct. Jan. April July Oct. Jan. April July Oct. Jan. April July Oct.
1928 1929 1930 1931 1932 1933 1934

Fig. 10—Relative Operating Cost and Basic Hourly Wage Rates Under Hand- and Mechanical-Loading Systems at Fairpoint. Operating Cost Is Expressed as a Percentage of the Average Cost for the Months of August, 1928-April, 1929, Inclusive, When Hand-Loading Prevailed. Basic Hourly Wage Rates Are Expressed as Percentages of the Rate From August, 1928, to September, 1931, Inclusive ($5 per Day, or 62½c. per Hour).

the following equipment: loader, cutting and shearing machine, one combination electric coal and slate drill, cable-reel locomotive and one ventilating unit (Robinson blower with Ventube or Flextube). The standard crew for an entry unit comprises seven men, divided as in Table I.

Again assuming the face cleaned up, the first operation in entry work is advancing the track for the cutter. After cutting and shearing is completed, the same crew drills both the coal and the slate. Shear cuts are made on the side in entries, and the coal is shot by one hole along the opposite rib, if possible, or, failing that, with two holes placed as in Fig. 2. When cutting and drilling are completed, the tracklayer again comes in to extend the track still farther for the loader, while his helper bug-dusts the cut. The tracklayer then shoots the coal, after which the loader takes out about two cars. Jumpers are then laid and the cut is finished. The loader is then moved back and the cutting-machine crew shoots down the slate. The machine then advances and loads the slate into cars.

Inspection of loaders and auxiliary equipment is placed in the hands of a mechanic, who looks over each machine each shift while it is operating. A greasing machine with a crew of two men visits each loader and cutter at least twice a week to supplement the routine lubrication activities of the operators. The operator of each piece of equipment submits at the end of the shift a list of mechanical difficulties to the mechanic at the shop, with a copy to the superintendent. Performance and delays are reported for each loading unit also at the end of the shift.

Fig. 4 shows the average daily tonnage per loading machine since mechanization started at Fairpoint, and pictures the striking difference in performance due to the installation of the 4.5-ton car. Final decision to purchase this size of car was influenced by the possibility of reducing car-changing time from 180 to 100 minutes per shift, with a corresponding rise in loading time from 135 to 205 minutes per shift. Performance and delays for each machine during a typical shift in October are set forth in Table II. The present standard performance is 634 cars of coal and 45 cars of stone on one day of three seven-hour shifts.

Two Myers-Whaley loaders also are employed at the Lafferty No. 6 mine of the Hanna company in cleaning up rock in old entries or in driving new ones. Willow Grove No. 10 employs an additional machine in entry-driving. Methods employed in solid work in each case are similar to those at Fairpoint.

Table I—Entry and Room Crews and Standard Performance Quotas, Mechanical Loading, Fairpoint No. 9 Mine

Classification	Rate per Shift	Number—Entry Units	Number—Room Units
Loader operators	$6.86	1	1
Helpers	5.28	..	1
Helpers—brakemen	5.28	1	..
Motormen	5.16	1	1
Brakemen	5.00	..	1
Cutters	6.86	..	2
Cutters—drillers	6.86	2	..
Trackmen	5.00	1	1
Helpers—bugdusters	4.76	1	..
Drillers—shooters	5.76	..	1
Bugdusters—drill helpers	5.76	..	1
Slate drillers (also post rooms)	5.00	..	2
Slate handlers	5.00	..	5
Preparation men	5.00	..	1
Total	....	7	17
Standard Performance Quotas			
Places per 7-hour shift, 22 ft. wide		..	8–9
Cuts per 7-hour shift, 9 ft. wide		6	...
Cars coal per 7-hour shift		19*	65*
Stone		6	...

*Average capacity, 4½ tons each.

Table II—Mechanical-Loading Record, Fairpoint No. 9 Mine, Second Shift (7 Hours), Oct. 10, 1934

Performance	Entry Units A-3	Entry Units E-3	Room Units B-3	Room Units C-3	Room Units D-3
Cars coal loaded (*a*)	20	16	66	72	65
Stone	6	8	..	..	..
Number cuts	6½	3½(*b*)	7½	9	8
Number of men working	6	7	17	18	17
Delays:					
Waiting on empties, min.	40	..	30(*c*)	..	45(*c*)
Tight coal, min.	..	..	..	..	..
Handling slate, min.	45(*d*)	..	30	..	..
Derailment, min.	..	..	..	..	..

(*a*) Average capacity, 4½ tons per car. (*b*) All room necks being widened. (*c*) Bin full. (*d*) Cleaning up fall on entry.

TRANSPORTATION

+ At Hanna Coal Co.

EFFICIENT mine transportation is essentially a matter of getting cars to the loaders, whether hand or mechanical, when and as often as needed. This presupposes, in addition to other factors influencing haulage performance (equipment, power supply, etc.), reduction of equipment travel to a minimum and a roadbed suitable for fast operation with fewest possible derailments and other interruptions. The workings of both these principles are illustrated at Hanna mines, one of which also furnishes an outstanding example of the effect of large cars on mechanical-loader performance.

While transportation is favored with a relatively gentle average dip of approximately 0.5 per cent to the southeast, local swales and swags often increase the gradient to several times that figure for short distances and occasionally require grading to smooth out haulage peaks. Three of the six Hanna mines (Dillonvale No. 1, Fairpoint No. 9 and Piney Fork No. 2) will work out within the next two years, and the others have been operated over long periods of time, with the result that hauls to the working sections generally are long—occasionally reaching 3 miles and frequently exceeding 2 miles. Gathering haul, on the other hand, rarely exceeds 1,300 ft., and generally is around 600 to 700 ft. This favorable condition is inherent in the mining system, but is supplemented by a gathering arrangement which, in the absence of unusual conditions, assures a haul within these limits.

In hand-loading mines, two of which —Willow Grove No. 10 and Piney Fork No. 1—are scheduled for mechanical loaders and cleaners, the mining system (pp. 455) is based on turning a total of 72 rooms on 30-ft. centers both ways from the room entry, which consists of two headings 8½ ft. wide. Room entries are first driven up to their maximum depth before the necks are started, and the two inbye groups of eighteen rooms each on opposite headings are driven up simultaneously, after which the two outbye groups are worked out, also simultaneously.

As loaded cars, as a rule, are made into trips within the entry, the longest haul from the face of the farthest room at its maximum depth of 250 ft. to the mouth of the entry would not exceed 1,300 ft. Ordinarily, it would be much less, as cars generally are stored opposite the rooms, angling crosscuts between headings being provided at intervals to permit passage of equipment from one to the other without going out to the mouth of the entry. Where possible, haulage locomotives come into the room entries for trips, thus eliminating hauling by the gathering equipment to sidetracks on face (cross) or main entries.

The generally favorable gradients and the short gathering distances made possible by the mining and haulage plans have been one of the major reasons back of the continuation of mule gathering at the two hand-loading operations about to be worked out, as well as at Willow Grove and Piney Fork No. 1, where locomotive haulage will accompany the installation of mechanical loaders and larger cars. Gathering at Lafferty No. 6 is performed exclusively by seven 5-ton Goodman and one Jeffrey crab-reel locomotives.

Gathering locomotives also are used at Piney Fork Nos. 1 and 2 in sections where the local gradients make animal haulage impracticable. Piney Fork No. 1 employs in this service two 4-ton Ironton storage-battery locomotives with "Exide-Ironclad" Type MVA 49-cell batteries. Two sets of batteries enable the locomotives to operate two shifts. Mine-car equipment consists of 20 wooden and 300 composite cars with Timken-bearing wheels. At Piney Fork No. 2, now entirely on the extraction of entry pillars, a crab-reel has been added to a spare 13-ton Jeffrey haulage locomotive for handling cars in places with gradients up to 15 per cent, in addition to a 6-ton Goodman cable-reel machine.

Haulage equipment in use at the hand-loading mines, with two exceptions, consists of 13-ton locomotives. Equipment by mines is as follows: Dillonvale No. 1—three 13-ton (two Jeffrey and one Goodman); Lafferty No. 6—two 13- and one 10-ton Jeffrey; Willow Grove No. 10 (wooden cars equipped with Hyatt bearing wheels)—one 13-ton Jeffrey; Piney Fork No. 1—three 13-ton Goodman; Piney Fork No. 2—three 13-ton Jeffrey with "Arcmaster" control. Trip sizes vary from 35 to 60 cars, depending on car capacity, equipment available, gradients and other factors.

Fairpoint No. 9, as pointed out above, furnishes an example of the effect of a larger car on loading-machine performance. This operation, which has served as the company's testing labora-

Table I—Average Transportation Performance at Hanna Mines in October, 1934

	Dillonvale No. 1(a)	Lafferty No. 6	Fairpoint No. 9(a)	Willow Grove No. 10	Piney Fork No. 1	Piney Fork No. 2(a)
Shifts per day	1	1	3	1	2	1
Aver. tons mined per day	700	1,950	2,340(b)	2,350	2,700	2,000
Gathering haulage:						
No. mules, 1st shift	6	....	....	15(c)	7	15
2d shift	...	....	....	....	4	....
No. locomotives, 1st shift	...	8	5	....	2	2
2d shift	...	....	5	....	2	....
3d shift	...	....	4	....	....	....
Main haulage:						
No. locomotives, 1st shift	2	3	2	1	3	3
2d shift	...	....	2	....	2	....
3d shift	...	....	2	....	....	....
Max. haulage, miles	1½	2	2	2	3	1¼
Min. haulage, miles	1½	1½	1¾	2	1¾	1
Mine cars in use	190	400	92	430	320(d)	500
Approx. capacity, tons, each	2.25	2.5	4.5	3.0	3.0	1.9
Cars coal dumped per day	310	840	630	745	950	1,070
Cars rock dumped per day	40	90	45	115	95	145

(a) To be worked out in two years at present rate. (b) After preparation; average reject, 17 per cent. (c) Including two at night; mules to be replaced by locomotives. (d) Includes 20 wooden cars with a capacity of 4,500 lb.; remainder are 3-ton composite cars.

tory, was equipped with a washery in 1929 as the first step in a mechanization program. Installation of loading machines in wide work was begun in 1930, and in entries in 1931, displacing the conveyors formerly employed in entry work. With both mechanical loading underground and mechanical preparation on the surface working smoothly, officials embarked on a series of tests designed to prove their conviction that the 2-ton cars then in use were the remaining weak link in the chain, track having been one of the first points of attack. As a result of these tests (*Coal Age*, Vol. 38, p. 175), a trial installation of seventeen 5-ton Differential side-dumping cars designed in accordance with specifications laid down by Hanna engineers, went into service on Aug. 1, 1931. Seventy-seven more were installed on Jan. 1, 1932, and 92 of the original 94 are still in service.

Results of the change-over to larger cars are shown graphically on p. 463 of this issue. From 278 tons in 1930 and 269 tons in 1931, average production per machine per shift in wide work rose to 343 tons in 1932 and 325 tons in 1933, an increase of nearly 25 per cent, due primarily to a reduction in car-changing time (180 to 100 minutes per shift) accompanied by an increase of from 135 to 205 minutes per shift in average loading time.

General features of the Fairpoint car include: all-steel construction; ability to dump to either side; four two-wheel caster trucks with 10-in. Timken-bearing wheels; and Willison automatic couplers. These casters are mounted independent of each other and operate from a king-pin. Capacity, level full, is 160 cu.ft., or, as loaded by the machines, 4½ tons. Height is 42 in.; over-all length, 14 ft. 8½ in.; over-all width, 5 ft. 7 in.

Installation of the new cars was accompanied by the construction of a 200-ton raw-coal bin to smooth out the flow of coal to the preparation plant. Cars are never uncoupled, but are pulled across the top of the bin by the haulage locomotive, which operates on a track laid along the center line. Two Dongbeater air-operated dumps, each running on its separate track laid parallel to the haulage track, are employed to dump the cars. In dumping to one side, the corresponding dump on the opposite track is used, and is propelled from place to place along the bin by a traction motor. When dumping to the other side, the second Dongbeater machine is used. Signal lights operated from push-buttons on the dumps control the movements of the trips. Slate cars are dumped into a separate bin equipped with its own dumping mechanism.

Gathering equipment at Fairpoint No. 9 consists of three 5-ton Goodman cable-reel locomotives and two 6-ton Jeffrey machines, the latter completely equipped with anti-friction bearings to

Trip Entering the Dump House at Fairpoint No. 9.

This 60-Lb. Track Laid on Steel Ties With Slag Ballast at Piney Fork No. 1 Typifies Hanna Practice.

Semi-Portable Turnouts Laid With Special Steel-Tie Sets, Such as the Lafferty No. 6 Installation Shown Here, Are Used on All Room Entries.

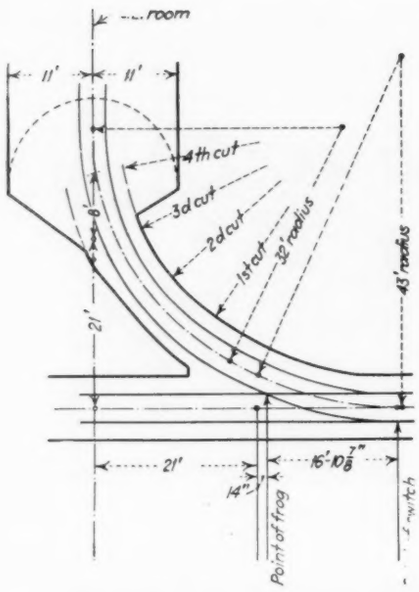


Fig. 1—Standard Plan for Installing Turnouts With No. 2½ Frogs Where Rooms Are Turned at 90 Deg.

increase capacity and reduce power and maintenance costs. Two Jeffrey 10-ton trolley locomotives with 13-ton electrical equipment haul from all five working sections. (Gathering methods are outlined in the article beginning on p. 462.) With the limited number of cars available, a definite quota, depending upon requirements, is assigned to each section, and when dumped are returned to the territory from which they came, to avoid loader interruptions due to maldistribution.

The Hanna attitude toward track is reflected in the fact that at the mines taken over in late years from other companies one of the first tasks was cleaning up and re-laying main roads with slag ballast and new ties. Supplementary activities include, where necessary, the reduction of gradients and the straightening of haulage entries. Both Carnegie steel and wood ties are used on main roads, with the former occupying the predominant position as a result of satisfactory operation over a period of years. Slag ballast (¾-in.) has been the general practice since 1918. Curve radii into room entries have been standardized at 75 and 90 ft. and a minimum of 120 ft. elsewhere, and construction practice embraces the use of manganese-steel frogs.

Steel ties and 30-lb. rail are standard for room entries and rooms, the one important exception being Willow Grove No. 10, where 25-lb. steel is used. Turnouts are laid with No. 2½ frogs on special West Virginia Rail Co. steel-tie switch sets. This type of track, experience has shown, meets efficiently the

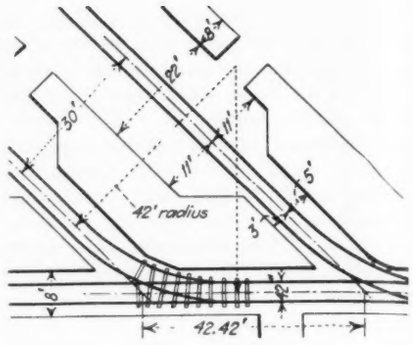


Fig. 2—Standard Plan of Installing No. 2½ Turnouts in Mechanical-Loading Territories, Where Rooms Are Turned 45 Deg.

requirements of gathering service; can be torn up and relaid elsewhere with a minimum of labor and a maximum recovery of material; and is sufficiently heavy to permit haulage locomotives to come into the room sections for trips.

General practice in laying turnouts in places turned at 90- and 45-deg. angles is illustrated in Figs. 1 and 2, respectively. The 45-deg. room has been adopted for mechanical loading to facilitate the movement of equipment into and out of places, and in hand-loading mines the room necks are curved to allow the use of a longer radius than otherwise would be possible.

Dumping a Car Into the 200-Ton Bin at Fairpoint. The Second Dumper Is Shown at the Rear of the Bin at the Left.

SURFACE PREPARATION

+ At Hanna Coal Co.

PREPARATION at Hanna mines serves a dual purpose; the first objective is the traditional one of cleaning and sizing the mine output to meet the demands of the market; the second objective, and one which is becoming increasingly important in bituminous mining, is closely related to the mechanization of loading underground. Efficient operation of loading machines, in the absence of modifying factors, presupposes loading the entire seam, including banded or other impurities, into the mine car, and, therefore, requires the installation of compensating cleaning facilities on the surface. Operation of this rule is illustrated by developments at the Fairpoint No. 9 mine, where the first step in installing mechanical loaders was the erection of a washery to remove the added impurities which had to be loaded to secure efficient operation.

While the Fairpoint program was embarked on after a thorough investigation which indicated its feasibility, the work was experimental in that the results were to serve as a guide in similar modernization programs at other operations possessing suitable conditions. Convincing evidence of the success of the Fairpoint experiment is afforded by the company's program to mechanize at least two other mines and by the fact that the preliminary step at one—installing adequate preparation facilities—already has entered the first stages with the preparation of plans and the letting of a contract for the washing equipment.

The Fairpoint plant, in view of its success in meeting the conditions growing out of loading the Pittsburgh No. 8 seam mechanically, naturally served as the model for the new installation. As originally built in 1929, Fairpoint (*Coal Age*, Vol. 36, pp. 527-31) was equipped with a Link-Belt-Simon-Carves washer for the 4x0-in. size, permitting the shipment of hand-picked 4-in. lump and the following washed sizes in dimensions to suit market requirements: egg, nut and slack, as well as combinations of any or all of the primary sizes, including special stoker.

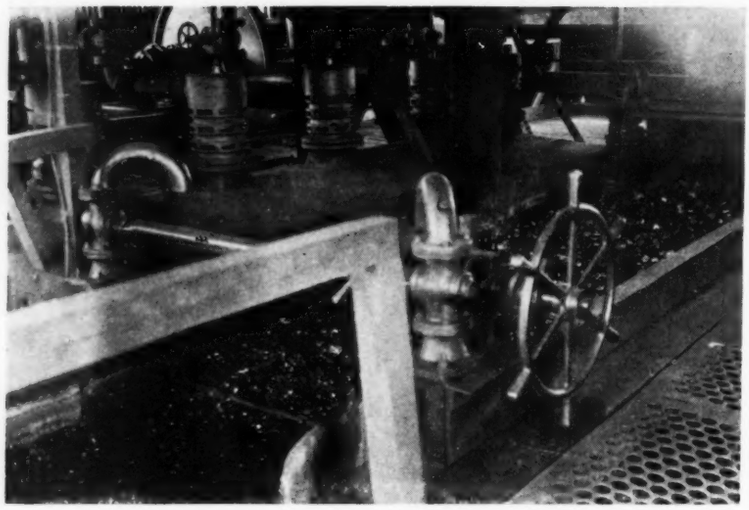
Ruggles - Cole pulverized-coal-fired equipment for drying the minus ¾-in. material from the washer was added in 1930, and in 1932, when the old 2-ton rolling stock was replaced with 4½-ton cars (see p. 466 of this issue), a 200-ton raw-coal bin was constructed to even out the flow of coal to the plant and guard against interruptions. Started originally as a single-shift operation, Fairpoint went double shift in August, 1931, and triple shift in May, 1934.

The capacity for which the Fairpoint plant was designed (125 tons per hour of raw coal) has been exceeded consistently since its installation, with the result that the washer, rated at 100 tons per hour for clean coal, has handled regularly a 25 to 40 per cent overload. In spite of this, the ash in shipments, as a rule, has been held comfortably within the normal upper limits demanded by the sales department. On certain tonnages sold on the basis of a guaranteed analysis, ash figures of 7 per cent or less have been secured. Washer operators are expected to keep within a tolerance —plus or minus—of 0.25 per cent ash, and it is possible to clean down to within approximately 0.5 per cent of the inherent ash of the coal.

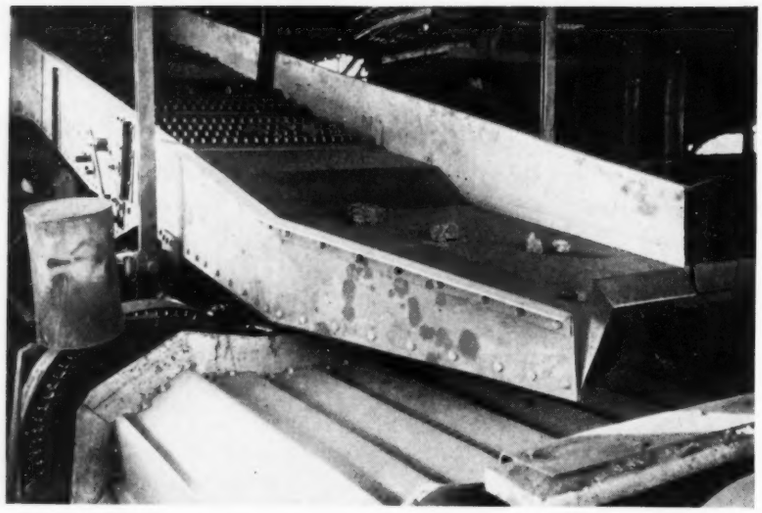
Input to the plant at present is 2,800 to 2,900 tons of raw coal per day of three shifts; shipments average 2,340 tons per day. Primary sizes now produced are: 4-in. lump, 4x1½-in. egg and 1½-in. x 28-mesh stoker coal. The ¾-in. x 28-mesh size is dried and mixed with the 1½x¾-in. coal. If desired, 2-in. or 1¼-in. screenings may be substituted for the 1½-in. stoker coal; in that case, the minus ¾-in. (including the minus 28-mesh material, which otherwise is run to a storage pond) is mixed back, either dried or not, as required.

Of the five remaining Hanna operations, Dillonvale No. 1 and Piney Fork No. 2 will be worked out in less than two years and Piney Fork No. 1 and Willow Grove No. 10 are scheduled for mechanization. Preparation at four of the five plants at present is based on shaker-screen separation and hand-picking of the prepared sizes—usually lump and egg, with nut additional at Willow Grove No. 10. Picking is designed to complete the work started at the face, where the company insists on the removal of all possible impurities, and surface plants are equipped with mercury vapor or day-blue lights to facilitate this operation. Prepared sizes, with one or two exceptions, are boom-

Fairpoint No. 9 Preparation Plant, Designed to Supplement Mechanization Underground.



Fairpoint Washer, Handling 4x0-In. Coal.



General Practice At Present Hanna Plants—Shaker Screens for Sizing Followed by Hand-Picking.

loaded at the four shaker-screen plants. At the fifth plant—Dillonvale No. 1—designed primarily for the production of railway fuel—the raw feed is separated into lump and resultant on a Niagara scalping vibrator with square-hole perforations ranging from 8 to 10 in., depending upon the size of the resultant desired. The vibrator also acts as a breaker in reducing fractured lumps for railway fuel. With the bar screen formerly used, long slabs frequently were encountered in this product. Lump is loaded over a bar screen to further remove degradation. Pickers on the rope-and-button conveyor feeding the plant and in the railway-fuel cars complete the cleaning job started underground.

Lafferty No. 6—the only shaft operation—is equipped with two loading machines for cleaning up or driving headings. When engaged in the latter task, the coal is segregated and dumped separately, whereupon the tipple is slowed down to permit complete cleaning by the pickers. Magnets for removing tramp iron are used on shaker screens at Piney Fork Nos. 1 and 2 and Willow Grove No. 10; ahead of the vibrator at Dillonvale No. 1; and ahead of the egg boom at Lafferty No. 6. These magnets, supplied by the Hocking Valley Mine & Mill Supply Co., are individually designed for operation in the bottom of chutes and slow-speed shakers, and are operated by direct current.

The new preparation plant, now awaiting a decision as to location, is modeled, as noted above, after the Fairpoint No. 9 operation, with, however, additional features designed to increase flexibility and recovery, prevent segregation of the wet and dry fractions in making up the slack and stoker sizes, and simplify the dewatering of the fines. Rated capacity of the new plant is 360 tons of raw feed per hour, and two Link-Belt-Simon-Carves six-cell two-compartment wash boxes with an aggregate capacity of 300 tons per hour of clean coal will be installed to wash the 4x0-in. size. Tentative primary sizes are: hand-picked and boom-loaded 4-in. lump, washed 4x2-in. egg (boom-loaded), washed 2x1½-in. nut (boom-loaded), and washed 1½-in. slack or stoker, of which the minus ½-in. fraction may be heat-dried. Provisions also have been made for crushing and rescreening all sizes above slack, if necessary.

Installation of the new plant will be followed by the installation of loading machines to handle the entire tonnage and, it is expected, by the adoption of mine cars similar to those in use at Fairpoint (p. 466). Consequently, dumping arrangements at the new plant will correspond in type with those at No. 9, although provision has been made for the temporary use of crossover dumps. When installation of the loaders and the new high-capacity cars is completed, however, trips from the mine will be pulled across the tops of the raw-coal and rock bins by the haulage locomotive, and the cars will be dumped to either side, as desired, except for rock cars, which will dump from one side only into the 100-ton rock bin designed to permit the use of either a larry or an aerial tramway for refuse disposal.

The raw-coal bin will include two compartments with capacities of 200 and 175 tons respectively. Reciprocating feeders will discharge the coal onto the lower strand of a chain-and-flight conveyor leading up to the feed shaker. Plus 4-in. (lump) coal from the feed shaker will go to an apron-type picking table with space for two groups of pickers. The first group will concentrate primarily on the removal of rock, which will be chuted to a tipple refuse bin, also designed for either larry or aerial-tramway disposal. Laminated material removed by the second group of pickers will be chuted to a middlings crusher where it will be reduced to 1 or 1¼ in. before being discharged onto a cross conveyor leading back to the raw-coal conveyor feeding the wash boxes.

Picked lump from the table ordinarily will go to a bar screen with 4-in. openings to remove table degradation, which also will go over the cross conveyor to the washer feed conveyor. Facilities will be provided, however, for crushing the 4-in. lump to a maximum size ranging from 4 in. down to 1½ in., and for separating the resultant into plus and minus 1½-in. fractions on a vibrating screen located near the feed end of the washed-coal classifying shaker. Plus 1½-in. material from the vibrator will discharge onto the classifying shaker, while the minus 1½-in. material (slack) will go directly to the railroad car or onto a slack and mixing conveyor for combination with other sizes.

The primary feed to the wash boxes will consist of 4x0-in. raw coal from the

feed shaker, crushed material from the picking table and undersize from the bar-type table degradation screen. Refuse from the first compartments of the wash boxes (each compartment consisting of the three cells at the feed end) will discharge onto the refuse conveyor. Refuse from the second compartments (each consisting of the three cells at the discharge ends of the wash boxes) also will be discharged onto the refuse conveyor in case special shipments are made. Ordinarily, however, this No. 2 refuse will be conveyed to a vibrating screen for separation into plus and minus 1- or 1¼-in. sizes, the undersize going to the refuse bin and the oversize to the middlings crusher already mentioned, where it will join the material from the picking table and continue on to the washer feed.

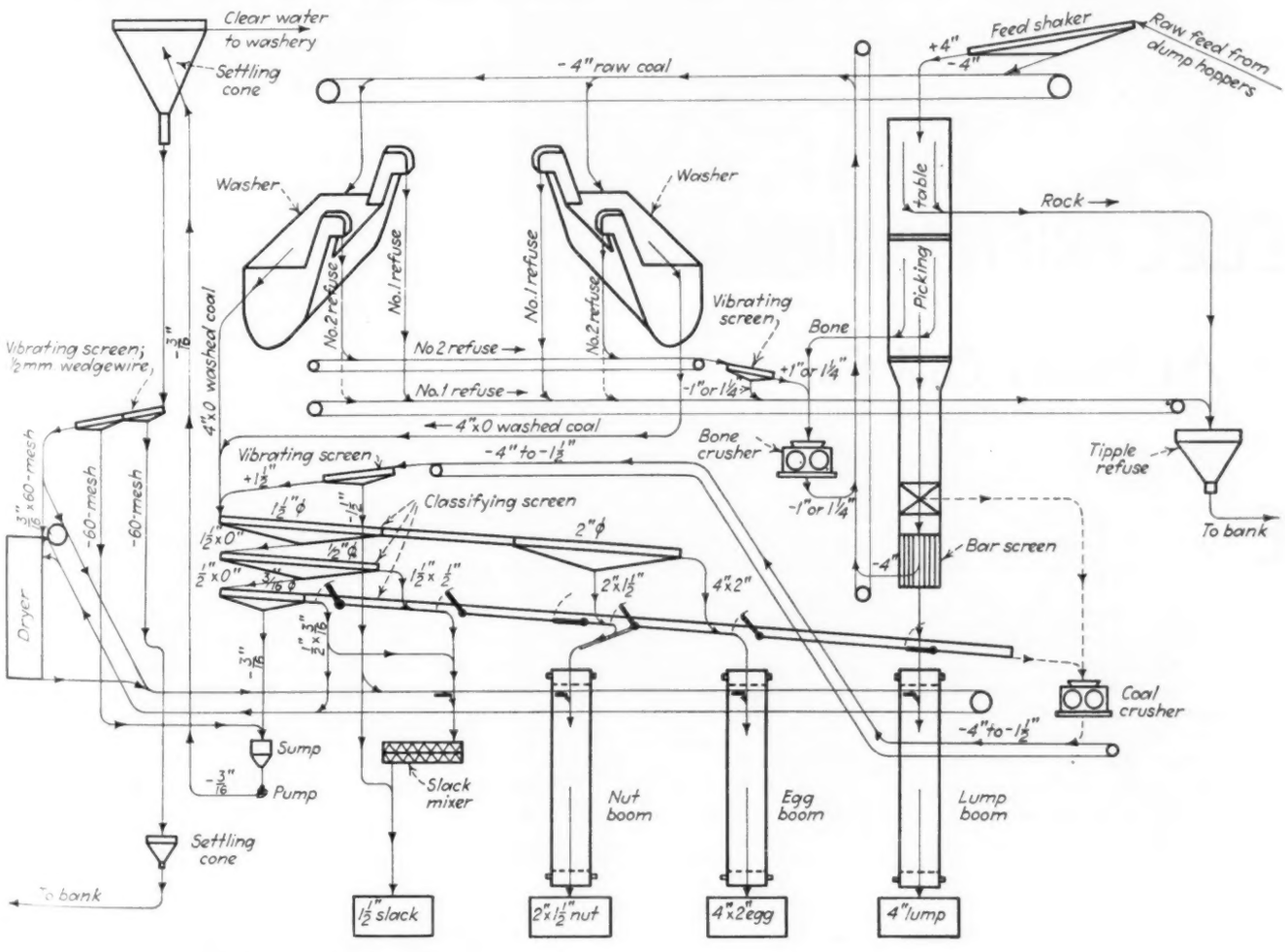
Cleaned coal from the wash boxes will flow to the classifying shaker, which will be made with three decks. The top deck will consist of two sections separated by a blank plate. Washed coal fed onto the shaker will first pass over a section with 1½-in. round perforations, the remaining 4x1½-in. material then going to the second section with 2-in. perforations for making 4x2-in. egg and 2x1½-in. nut. When loading primary sizes only, the lump and egg will drop through gates in the lower deck onto the respective loading booms. Minus 1½-in. slack through the first section of the top deck will drop onto the second deck for further division into 1½x½- and ½x0-in. fractions, the former dropping through a gate in the bottom deck into the slack mixer located under the feed end of the shaker. The mixer, consisting essentially of two screw conveyors revolving in opposite directions, is designed to recombine the various fractions making up the 1½-in. slack to prevent segregation.

The minus ½-in. size from the second deck of the shaker will be still further divided into ½x$\frac{3}{16}$- and $\frac{3}{16}$x0-in. fractions on the upper end of the lower deck. The ½x$\frac{3}{16}$-in. fraction will drop into the mixer, if wet slack is being loaded, or onto the lower run of the slack and mixing conveyor for transportation to the dryer in case the slack is loaded with the minus ½-in. fraction dried. Minus $\frac{3}{16}$-in. coal through the bottom deck will flow with the wash water to a sump tank, from which it will be pumped to a 200,000-gal. settling cone. Clear water from the top of the cone will supply the wash boxes, while the sludge, consisting of about 40 per cent solids under $\frac{3}{16}$ in. and 60 per cent water, will be tapped off at the bottom of the cone onto a vibrating screen fitted with ½-mm. wedge-wire sieves. Material through the first sieve section will be pumped to the bank, while material through the second sieve section will be recirculated to the settling cone. Material over the sieve sections ($\frac{3}{16}$-in. x½-mm.) will go either to the dryer or onto the top strand of the slack and mixing conveyor for transportation to the mixer when loading wet slack. If the material is run to the dryer, it will join the ½x$\frac{3}{16}$-in. fraction, which also will be discharged onto the upper strand of the slack and mixing conveyor for distribution.

Separation of the ½x0-in. fines and their treatment as outlined above, it is felt, will relieve the dewatering screens of much of the water burden which otherwise would be encountered, and will reflect the difference between handling approximately 4,000 gal. of water per minute carrying a small percentage of solids and 270 g.p.m. carrying 40 per cent of solids.

Both the gates in the bottom deck of the classifying screen and the mixing conveyor function in the loading of combinations, but mixtures of all sizes

Flowsheet of Preparation Plant Scheduled for Installation at Another Mine to Be Converted to Mechanical Loading.



down to slack are possible with the former only. By closing all the gates in the bottom deck back to the 1½x½-in. gate, for example, it will be possible to load 1½-in. lump over the lump boom. Opening the gate over the egg will make possible loading a 1½x4-in. size, and so on. Also, by closing the gate over the lump boom along with the rest, it will be possible to run the washed 4x1½-in. size to the crusher mentioned above for reduction and rescreening. In loading clean mine-run where, for example, the minus ½-in. fraction is to be loaded wet, all gates on the lower deck of the shaker will be closed, diverting all coal from 4 in. down to ⅜ in. to the lump boom. The remaining minus ⅜-in. material, after passing the dewatering screens and bypassing the dryer, would be brought to the lump boom on the top strand on the slack and mixing conveyor. A similar adjustment of gates, coupled with a corresponding routing of the ½x⅜- and ⅜x0-in. fractions will make it possible to load cleaned mine-run containing a dried ½-in. size.

Operation of the new plant will be controlled on the ash-analysis basis already in use at other Hanna mines. Float-and-sink figures are not employed in daily control, as the company takes the stand that the primary interest of the customer is in the actual ash—or, rather, lack of ash. Samples for control purposes will be taken automatically, as at Fairpoint, and will cover washer feed, clean coal and refuse.

Larries, as at Lafferty No. 6, Generally Are Used for Refuse-Disposal.

One man is employed continuously at Fairpoint to oversee hand-picking and handle samples, and the same plan will be followed at the new plant. Surface preparation at the hand-loading mines is checked by a crew of coal inspectors under a chief inspector. Among the qualifications of the latter is a thorough knowledge of firing practices, which enables him to act as trouble-shooter in the plants of Hanna customers.

The duties of the inspectors include periodic surveys of hand-picking methods at all plants, underground investigations, when necessary, and sampling of the prepared sizes. Delegation of the latter duty to relatively high-salaried men, in the opinion of the company, is warranted by the fact that their experience and capabilities insure efficient handling of samples and, consequently, accurate results. Routine control methods are supplemented by special studies of the coal at the various mines to evaluate cleaning possibilities, and face sampling to secure comparison and control information.

Refuse disposal at Hanna mines is based largely on the use of turntable-type electric larries. One exception is Willow Grove No. 10, where equipment consists of a car hoist and also a switchback road up the hillside to the dumping station, on which is operated a self-propelled side-dump car. Piney Fork No. 2 also is equipped with a car hoist, while Piney Fork No. 1 employs a 10-ton Atlas larry with dynamic braking. Five-ton Connellsville larries are used at Dillonvale No. 1, Lafferty No. 6 and Fairpoint No. 9. Maximum distance traveled by larries is approximately 3,000 ft., and gradients run up to 13-15 per cent.

Willow Grove No. 10, where available dumping space with present equipment is limited, is scheduled for a 2,700-ft. aerial tramway equipped with eighteen 1½-ton buckets to handle 120 tons of refuse an hour. With this equipment, refuse will be deposited in the adjacent valley, as well as along the slope of the hill facing the existing tipple. Additional storage space will be made available by moving the tail and intermediate towers.

ELECTRIFICATION

+ At Hanna Coal Co.

ELECTRIC POWER that frequently dropped in voltage to the extent of 10 to 50 per cent and failed entirely many times during the day would be adjudged as power of "low quality." The Hanna Coal Co. does not make that common mistake of furnishing "low-quality" power to direct-current mining equipment—cutting machines, mechanical loaders and locomotives—which collectively form the very heart of mining operations. Increasing loads are forecast and provided for in so far as is practicable, and complete electrical surveys are made at least twice a year and prompt action taken to correct low-voltage faults. Copper, when needed to improve voltage, is considered one of the best equipment investments that can be made. Substations are relocated as often as operating conditions point to an advantage.

Power at 4,000 volts, a.c., 60 cycles, is purchased from the Ohio Power Co., at five metering points, to operate the six mines. The Piney Fork plants No. 1 and No. 2 are within a half mile of each other, so are served from a common metering point. Central metering for all is not practicable because of the distances involved. On a scaled map it requires a circle 16 miles in diameter to encompass the six plants. The Tariff C.P. (Capacity Power), governing the purchases of power, is based on the average of the three highest 15-minute integrated peak demands during the month and on the maintenance of an average power factor of 85 per cent with penalties for operating below that and premiums for operating above. At three of the metering points the coal company has facilities for checking the energy metering of the power company.

During the year 1933, when the company operated but five mines (Willow Grove No. 10 was taken over Jan. 1, 1934), the total power purchased amounted to 8,306,910 kw.-hr. Requirements per ton amounted to 4.62 kw.-hr. without deductions for house lighting. The net rate per kilowatt-hour averaged 1.44c. for the four metering points then involved.

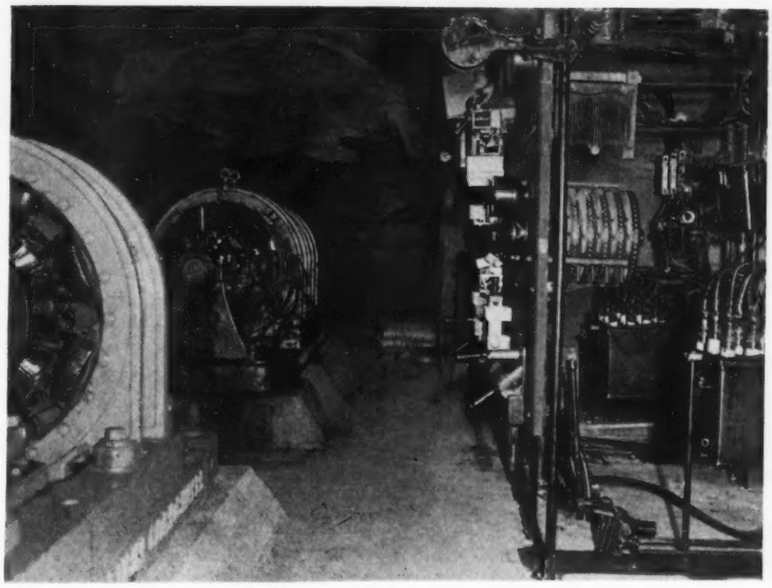
At Fairpoint No. 9 mine, which is equipped with mobile-type loading machines and a mechanical cleaning plant, the average power requirement for the year 1933 was 5.26 kw.-hr. per ton of coal shipped. Based on the same output, the cleaning plant alone consumed 1.8 kw.hr. per ton.

Because the power is purchased at 4,000 volts (Y-grounded neutral), which is considered a practical operating voltage for motors down to 50-hp. size and has the advantage of requiring no transformers, many of the larger motors are of that voltage. Motors wound for 2,300 volts are used only in two or three cases where the motors and transformers were on hand. The standard for motors below 50 hp. is 440 volts. Exclusive of the substations, the number of a.c. motors in use at the six mines totals 135 and the connected a.c. motor load is 2,446 hp., all induction motors. Direct-current substation generating capacity totals 3,600 kw. Fifteen units are synchronous converters and five are synchronous motor-generator sets. The synchronous motor load of the latter units totals 1,400 hp. Induction motors are loaded so nearly to capacity and substation requirements kept so closely adjusted that power factors at all metering points are above the "85 per cent lag" base.

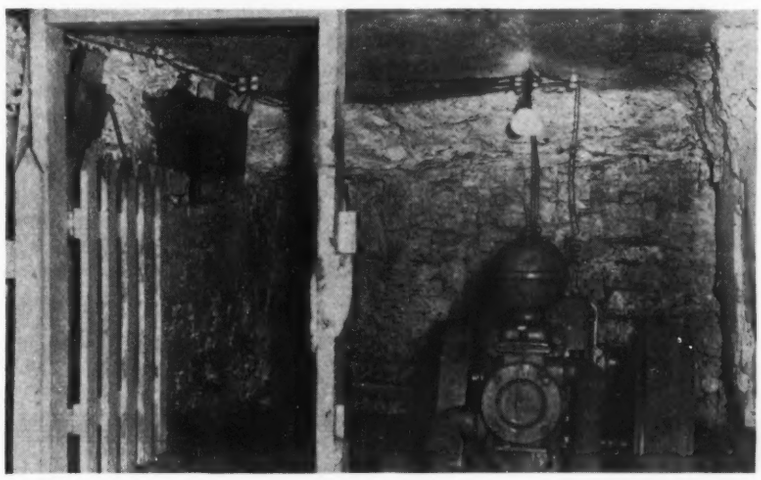
By reason of the multiple-shifting carried on at two of the plants and the consequent high load factors, power demand cost is held within reasonable limits in spite of the fact that at no time are any circuits manually or automatically interrupted to reduce the peak. Haulage is planned and dispatched to the best advantage of the power peaks, but in no case is the power consideration allowed to interfere with scheduled production. Investigation has failed to reveal any circuits which could be interrupted during the peak-load hours without causing time loss and increased labor cost.

Direct-current equipments in all of the mines are of the nominal 250-volt rating. At certain substations the voltage is adjusted to 275 at the switchboard at full load, and at others it is adjusted to somewhat higher voltages. By reason of the close check that is being kept on voltage conditions and the quantity of copper feeder installed, the mine officials at the various plants have become "copper conscious" and thus favor circuits of larger capacity than was formerly the rule.

Some time ago the management inaugurated the practice of having the electrical engineer check the copper in each mine every three months. Progress maps showing locations and sizes of all circuits and of equipments connected thereto are made for each mine. Recommendations for the adding of copper feeders are submitted and the compliances, as later reported, are checked on the next survey. After the



Substation Consisting of Two 200-Kw. Motor Generators Recently Installed in Willow Grove No. 10 Mine. Walls and Top Are Protected by Gunite. This Station Is Fed by a 4,000-Volt Cable 9,500 Ft. Long.

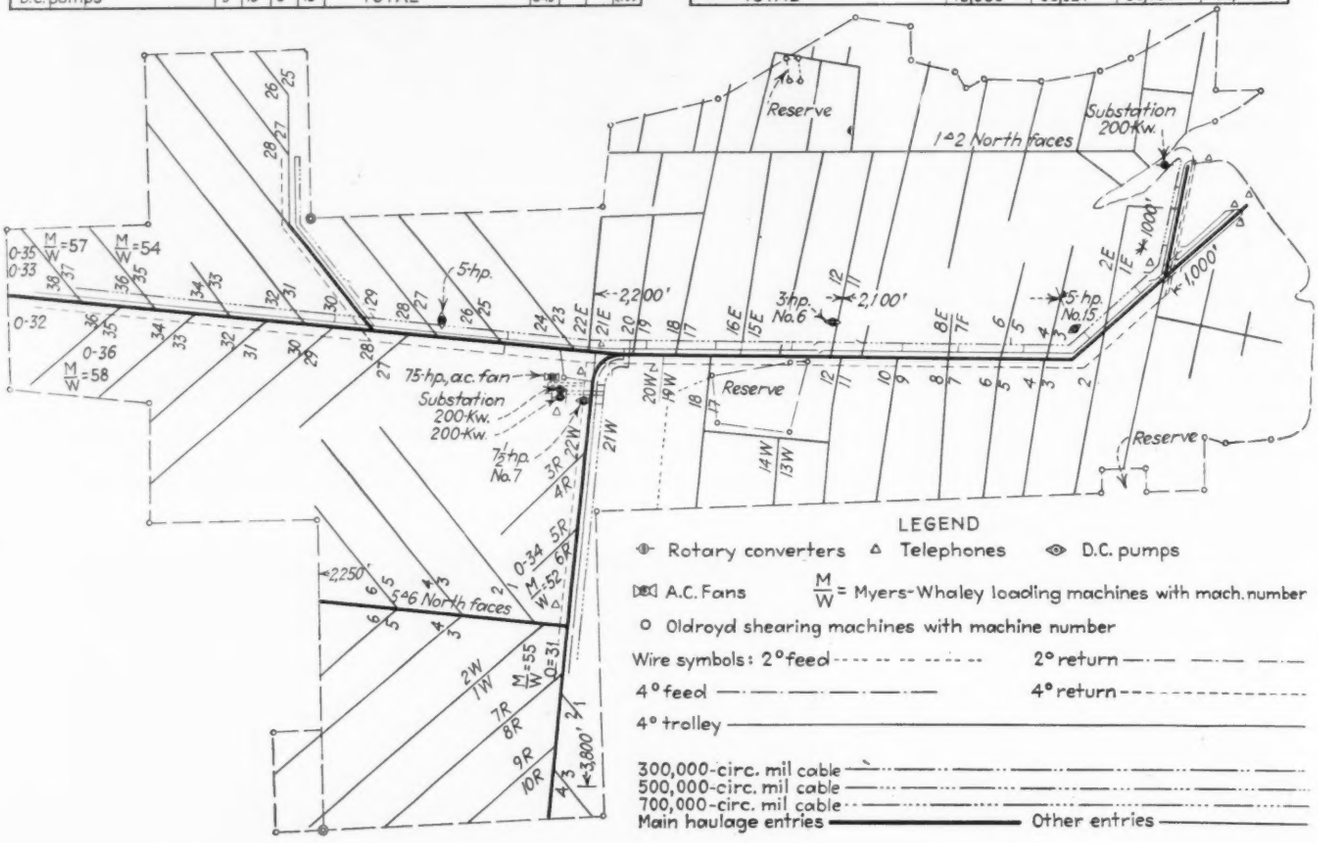


Belt-Driven Pump in Fairpoint No. 9 Mine. The Automatic Starter Is Mounted High on the Left-Hand Wall.

Two 1,000,000-Circ.Mil Feeders in Lafferty No. 6 Mine. Both Are Controlled by Safety Feeder Switches Such as the One in Sight Connected to the Left-Hand Feeder.

D.C. CONNECTED LOAD									
DATE	2-15-34		10-4-34		DATE	2-15-34		10-4-34	
Equipment	No.	Hp.	No.	Hp.	Equipment	No.	Hp.	No.	Hp.
Locomotives	5	500	9	720	Coal drills	10	8	10	8
Shortwalls	0	0	0	0	Blowers	3	6	0	0
Shearing machines	5	200	6	240	Room hoists	0	0	0	0
Mechanical loaders	5	105	5	115	Mach. shop motors	2	11	2	11
D.C. pumps	3	15	3	15	TOTAL	845			1109

WIRE IN USE				
Size	2-15-34		10-4-34	
	Feet	Lb.	Feet	Lb.
2° bare copper	0		0	
4° " "	56,900	36,700	43,880	28,303
300,000 circ. mil cable	0		0	
500,000 " " "	9,000	13,725	8,000	12,200
750,000 " " "	6,950	15,902	7,100	16,244
TOTAL	72,850	66,327	58,980	56,747

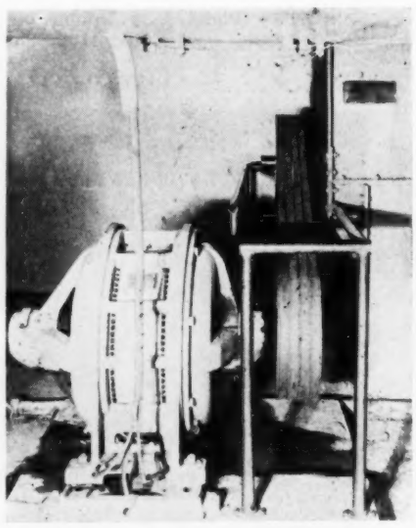


Direct-Current Wiring Progress Map, Fairpoint No. 9 Mine.

conditions were generally improved the time between surveys was lengthened to six months. A survey of October, 1934, showed an approximate total of 340,000 lb. of copper wire in use at the six mines, or an average of 30 lb. per ton of daily production. The range per ton for the various mines is 21 to 64 lb.

Bonding of tracks of main haulways, which are laid principally with 60-lb. steel, is by use of short bonds electrically welded to the ball or to the base of the rail, with the latter now the standard practice. Along the bonded track there is installed a No. 4/0 round copper return wire, this mounted on the rib about 2 ft. above the floor and tied electrically to the track at a crossbond at every eighth rail. The object of this copper return wire is not so much to add to the conductivity of the track return circuit as it is to insure that there will be no break in the circuit even though two bonds in the same section of track should accidentally become broken.

Tracks in room entries are not usually bonded. In sections using animal gathering, two No. 4/0 wires, one for feed and the other for return, are installed



V-Belt Drives Such as This One on a New Fan in Piney Fork No. 1 Mine Are the Standard for Fans.

in the room entry. In sections where mechanical loaders are used and in sections employing cable-reel locomotives for gathering, the feed consists of one No. 4/0 trolley wire on each of the two parallel headings and a No. 4/0 return wire along each track. By reason of the concentrated mining system employed, the room entries have a comparatively short life. In sections fully mechanized the life has been approximately 100 days, but in future workings it will be but 60 to 65 days. For tracks that serve such a short time in one place copper return wire is considered a practical economy as compared to bonding.

Stationary equipment operated from the d.c. system consists principally of mine pumps. Of the total of 39 pumps comprising a connected load of 288 hp., 13 of the pumps (125 hp. total) are in one mine, Piney Fork No. 2. Starting difficulties with d.c. pump motors have been practically eliminated by equipping them with the mine-type automatic starter made by the Ohio Brass Co. It is built to resist moisture, provides overload protection and is designed especially for the fluctuating voltage common to mining operations. Twenty-one pumps

are so equipped. One pump is equipped with Barrett, Haentjens & Co. motor-driven priming pump and full automatic protection and control features.

Storage-battery locomotives are used for gathering in the two sections of Piney Fork No. 1 mine that have grades too steep for animal haulage. These two locomotives are Ironton, 4-ton chassis, equipped with exchange-type battery box, making the total working weight approximately 6 tons. There is an extra box and battery for each locomotive and the four batteries now in use are the Exide Ironclad type MVA 49-cell, 27-plate rated 442 amp.-hr. at a 6-hour rate. While one battery is in use on the locomotive during one shift the other is being charged from a motor-generator set at a station which is located at a drift opening and beside a substation and fan where one man looks after all three. At Fairpoint No. 9 mine the gathering equipment includes two new Jeffrey 6-ton cable-reel locomotives equipped with anti-friction bearings throughout. The balance of the gathering equipment in use at the Hanna mines consists of eleven Goodman single-motor type 30B 5-ton locomotives.

Trailing cables used on cutting machines, loaders and locomotives are of the all-rubber insulated type. Two-conductor concentric and some duplex are used on the mounted cutters, two-conductor concentric on shortwall cutters and single-conductor on the locomotives. Conductor sizes are No. 1 on mounted and shortwall cutters, No. 2 on loading machines, and No. 3 on locomotives.

Lightning has several times caused damage to the 4,000-volt motors of the substation motor-generator sets fed by pole lines. This fact had a bearing on the decision to use cable through the mine instead of a pole line and borehole to feed a substation recently installed in Willow Grove No. 10 mine. Another consideration favoring the cable was freedom from line maintenance. The substation, consisting of two 200-kw. Ridgway synchronous motor-generator sets, is situated in a gunited room inside of the mine 9,500 ft. from the portal. The feed is a three-conductor No. 1 cable insulated with varnished cambric and protected by lead, steel armor and jute.

This cable is installed on the main haulway in a trench 18 in. deep cut with an Oldroyd machine. Splices, seven in number, are located in steel-covered boxes set back in the rib with the heavy steel covers flush with the coal surface. At a point 7,900 ft. from the portal there is connected to the first cable another of the same type, but size No. 8, which extends 3,100 ft. to a shaft where it supplies power to a 50-hp. motor driving a fan. In the same trench with the main power cable there was buried a two-conductor telephone cable, size No. 14, rubber insulation, protected with lead, steel armor and jute. The main cable is of sufficient size to handle an additional load of 200 kw.

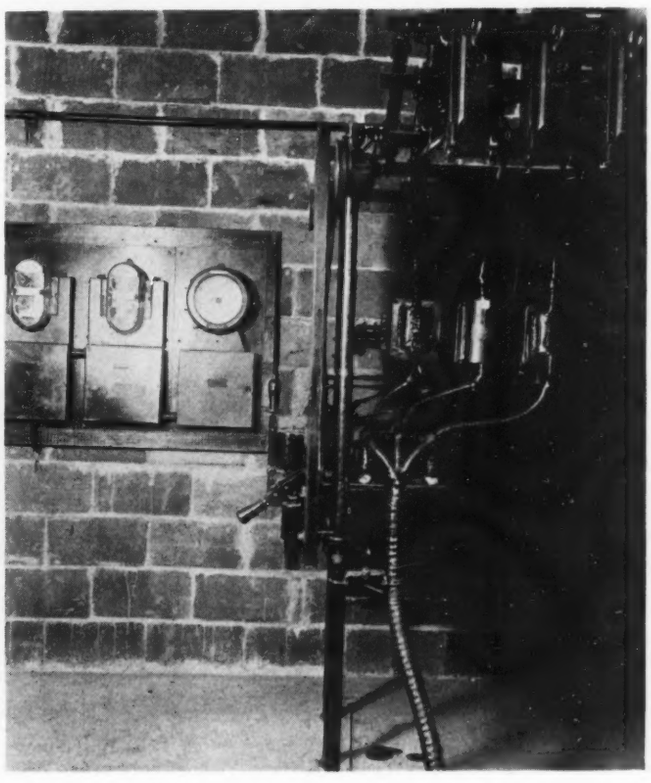
Gliders or contact shoes are replacing trolley wheels on main haulage locomotives. Wires over which the shoes operate are greased to reduce wear. It has been demonstrated that shoes and wheels cannot be used successfully over the same trolley wire. Shoes were tried originally because it was understood that their use would render impossible the dangerous practice of back poling, but it was found that with greased wires, a shoe can be backpoled with about the same facility as a trolley wheel.

Standardization of equipment is being carried on as fast as is practicable, considering the fact that three of the mines and equipments were acquired in the last five years. The track gage (42 in.) being the same at all six mines, it is possible to transfer mounted equipment without the expense of changing width. Purchases of new stationary motors are being limited to two makes, except in special cases.

Considerable has been done in the last few years to modernize the mine fans to reduce power requirements. At present nine fans are in use representing a total connected load of 395 hp. About one year ago the fan load at Lafferty No. 6 mine was reduced from 78 hp. to 52 hp. by the purchase of a new wheel designed to suit the mine requirements. A test on the improved fan showed an efficiency of 70 to 72 per cent. The saving in power cost amounts to over $200 per month. Recently there was installed at Willow Grove No. 10 mine a new 7x5-ft. Robinson centrifugal fan and at Piney Fork No. 1 mine a new Jeffrey Aero-

Haulway in Fairpoint No. 9 Mine. Positive Line Consists of a No. 4/0 Trolley and a 750,000-Circ.Mil Feeder. Two Bonded 60-Lb. Rails and a No. 4/0 Copper Wire Form the Return.

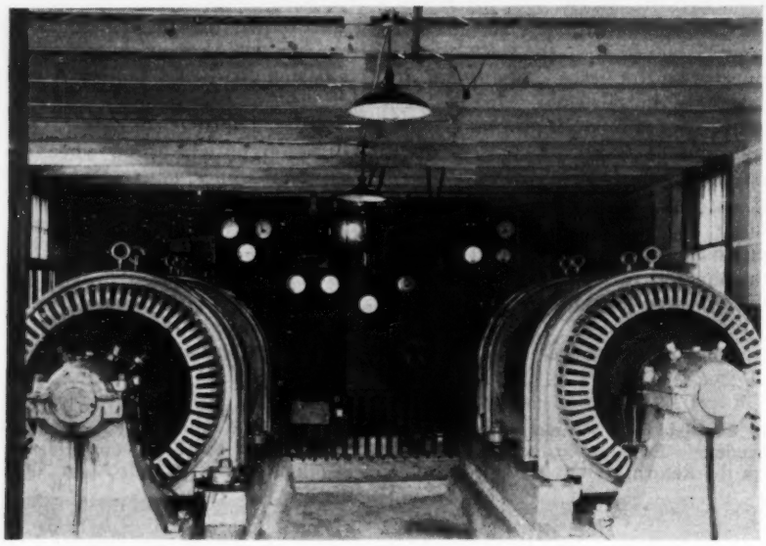
View in Switch and Meter House on Outside at Portal of Willow Grove No. 10 Mine. The Cable in the Foreground Is the 4,000-Volt Supply to a Substation 9,500 Ft. Back in the Mine.



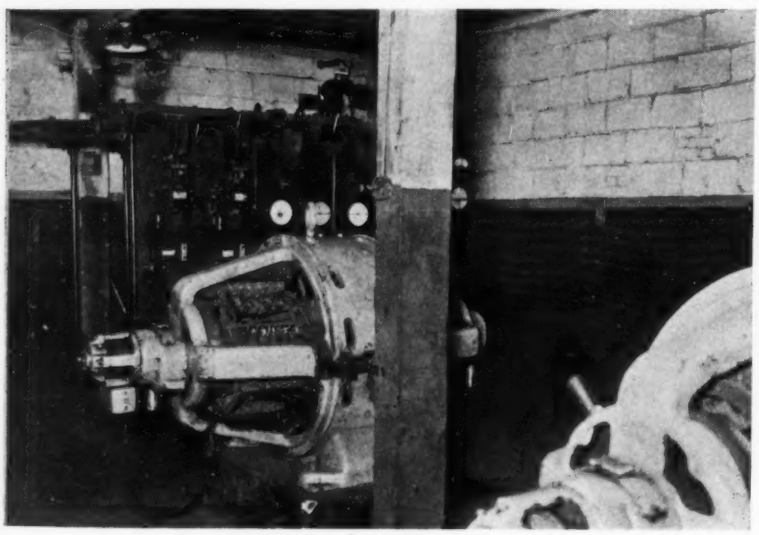
Principal Data Pertaining to Electrification

Mine	Type of Opening	Coal-Hoist Motor, Rated HP.	No. of Shifts Per Day	Total Tons per Day Shipped	Mine Pumps: Number	Mine Pumps: Total HP.	Mine Pumps: No. of Loading Machines	Electric Locomotives: Haulage	Electric Locomotives: Cable-Reel	Electric Locomotives: Battery	Electric Locomotives: Switching or Handling Supplies	A.C. Motors (Excluding Motor-Generator Sets): Mining Machines	A.C. Motors (Excluding Motor-Generator Sets): Number Connected	A.C. Motors (Excluding Motor-Generator Sets): Total Hp. Connected	Substations: Total Capacity, Kw.	Substations: Number Outside	Substations: Number Underground	Substations: Total Capacity Converters, Kw.	Substations: Total Capacity Synchronous Motor-Generators, Kw.	Average Power Factor of Total Plant Load	D.C. Connected Mine Load, Hp	Wire in Use D.C. Mine Circuits I.b. Copper
Dillonvale No. 1	Drift	...	1	700	8	75	..	3	..	..	..	3 Sw.	8	120	150	1	..	...	150	Unity	662	44,822
Lafferty No. 6	Shaft	150	1	1,950	7	87.5	2	3	6	..	1	2 Sw. 5 M.	22	550	650	2	..	650	...	.96 lag	1,177	76,017
Fairpoint No. 9	Drift	...	3	2,340	3	15.5	6	3*	5	..	..	6 M	46	680	600	1	1	600	...	.87 lag	1,109	56,747
Willow Grove No. 10	Slope	150	1	2,100	1	10	1	4	1	..	..	6 Sw.	28	695	800	1	1	400	400	Unity	794	44,450
Piney Fork No. 1	Drift	...	2	2,550	7	42.5	..	3	..	2	1	5 M. 1 Sw.	8	117	600	2	..	200	400	.98 lag†	731	65,657
Piney Fork No. 2	Drift	...	1	1,800	13	125	..	4	1	..	..	4 M. 16 Sw.	23	284	800	3	3	800	...	.98 lag†	1,812	51,456

* Two in use, one as standby. † Piney Fork No. 1 and Piney Fork No. 2 on same meter.



Recently Installed Outside Substation at Piney No. 1 Mine. Contains Two 220-Kw. Synchronous Motor Generators.



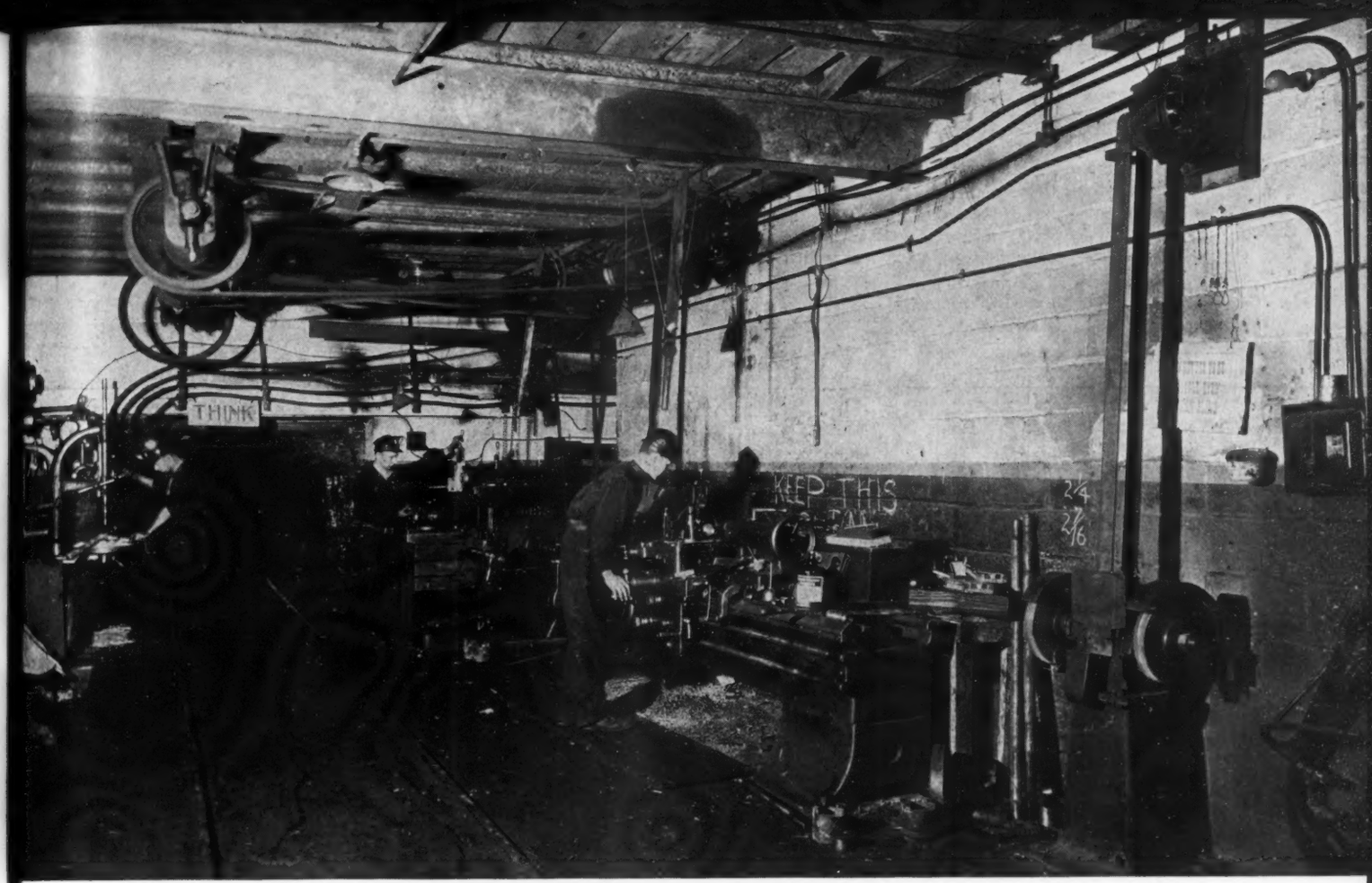
Two 200-Kw. Converters in Fairpoint No. 9 Mine. The Two Left-Hand Panels Are Feeder Breakers.

vane two-stage fan. In both cases the drives are 50-hp. motors connected with Tex-rope V-belts. The Jeffrey fan, which is equipped with Timken bearings, is driven at a speed requiring 33 hp. and is delivering more air than the fans, totaling 70 hp., out of service.

The four fans serving the various drifts at Piney Fork No. 2 are driven by d.c. motors of 20- and 30-hp. sizes. All other fans are driven by a.c. motors. Three are the wound-rotor type, one a squirrel-cage motor and another a two-speed motor. For fan-drive connections the standards call for the V-belt.

Adequate lighting to promote safety and facilitate work is an outstanding feature in the policy of the operating officials. Although the mines are practically free of explosive gas, permissible electric cap lamps are used exclusively. Edison lamps are used at the Willow Grove No. 10 mine and Wheat lamps at the other operations. It is felt that a cap lamp emitting light of constant intensity is a considerable factor in preventing accidents, and that its use also increases the efficiency of the worker.

Mine entries are illuminated at intervals of a few hundred feet by 50-watt 300-volt lamps powered from the trolley and feeder circuits. Lighting of picking tables in the preparation plants represents the best practice as recommended by prominent lamp manufacturers. Lafferty No. 6, the oldest installation, consists of four mercury-vapor units. The newer installations consist of 300-watt Mazda lamps in General Electric 16-in. day-blue dust-tight reflectors. These are hung 48 in. above the picking conveyor and spaced 3 ft. apart. The wattage per square foot of table is approximately 25 and the average intensity of illumination approximately 50 foot-candles, this allowing for some loss of efficiency by reason of dust accumulations on the outside of the glass between cleanings. Fifteen of these incandescent-lamp picking-table units have been installed.



Several Machine Tools Are Included in the Equipment of the Underground Maintenance Shop at the Mechanical Mine.

MAINTENANCE

+ At Hanna Coal Co.

HANDLING of equipment maintenance in a systematic way ranks close to first among the fundamentals that have been given due recognition by management of the Hanna Coal Co. in making an economic success of mechanical loading. And the same principles are applied in no lesser degree to equipment in mines still on hand-loading. Mechanical delays are being reduced and at the same time the maintenance cost is dropping in spite of the increased cost of materials and labor. A level has now been attained that when the mines open on a Monday morning it is practically assured that the equipment will operate the rest of the week without a serious tonnage delay.

Maintenance is under the jurisdiction of a superintendent of machinery and an assistant, who is an electrical engineer, both with headquarters at St. Clairsville. The master mechanic in local charge of maintenance at each mine reports to the mine superintendent, but, in all except controversial questions, he follows recommendations made direct by the superintendent of machinery. The latter acts to a considerable extent as a consultant to the management.

When total materials and labor maintenance cost of all equipment (including mine cars and lubrication but excluding track) at any mine runs below 6c. per ton of coal shipped, it indicates economical performance. And when the figure is below 16c. per ton at a mine operated with mechanical loaders and equipped with mechanical cleaning and drying equipment, that likewise indicates efficiency. Total maintenance cost at the Hanna mines falls within those limits, which speaks for itself.

At each mine a record is kept of every mechanical failure that causes a delay, and the record includes date, shift, equipment and designating number, time lost, and a classification showing if avoidable or unavoidable. At the end of each month, copies of these reports are sent to the St. Clairsville office, where they are condensed for comparative records and are studied with a view to improvement. Recurring difficulties are analyzed and action is taken to eliminate the underlying cause, even to the extent of redesigning a part which appears unequal to the duty.

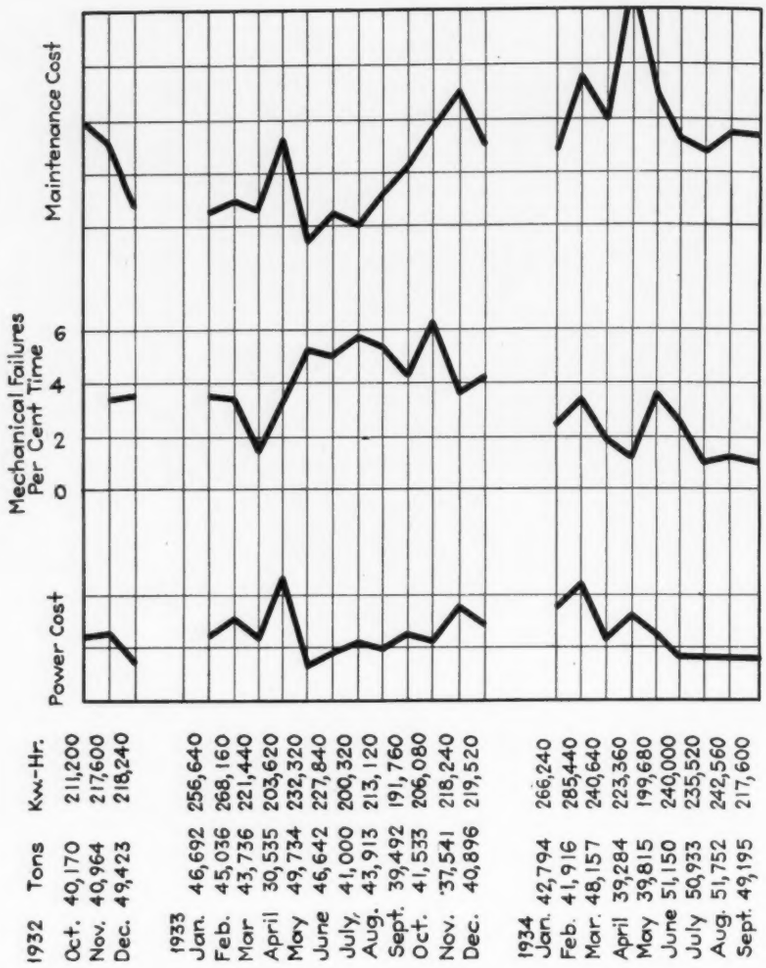
A few specific items serve to illustrate the practice: Loading machines were being delayed repeatedly by failure of the hydraulic hose. A type of hose more suitable to the duty was found, and since standardization on its use practically no delays are chargeable to hose. On a certain type of machine repeated trouble was eliminated by replacing a chain drive by a bevel gear. Shaft-breakage troubles in two types of face equipment were eliminated by renewing with shafts made in the mine

shops from rough "Simplex Forgings," a chrome-manganese steel product of the Crucible Steel Co. This material can be tempered to tool hardness and cutting it with a torch automatically makes it too hard for machining.

In the matter of making out delay reports, section bosses are instructed to follow a definite procedure. They time the delay and, if no spare equipment is available, the total time out of service is reported as the delay to the machine. If a spare machine is available and is brought into use, the reported delay to the failed machine is only the actual time required to transport the spare machine and get it into working position. Section bosses are required to make the reports instead of the repairmen, because the foremen have no reason to understate the delays.

As an indication of maintenance accomplishment note the improving record for mechanical loading machines in Fairpoint No. 9 mine: For the year 1933 the average time delay for all of the machines was 4.32 per cent. For the first six months of 1934 the average delay was 2.6 per cent, and for August and September it was below 1.5 per cent.

There is a small machine shop at each mine, except in the case of the two Piney Fork mines, where a central shop was built within the last year. In addition to handling the work for the Piney Fork mines, this shop will handle heavy repairs on certain equipment which will be shipped from the other mines. Equipment in this central shop consists of the following: ⅜-in. to 2½-in. bolt threader; 50-in. boring mill (principally for tire turning); 200-amp. electric welder; one 26-in. lathe; one 24-in. lathe; one 16-in. lathe; one 16-in. shaper; 5-ft. radial drill; 450-ton hydraulic press; 52x112-in. heavy-duty milling machine; planer, 10 ft. bed x 30 in. between rails; double-wheel emery grinder, and air compressor. All armature-winding jobs are sent out to commercial shops and no foundry equipment is provided for at the shop making brass or iron castings.



		Kw.-Hr.
1932	Tons	
Oct.	40,170	211,200
Nov.	40,964	217,600
Dec.	49,423	218,240
1933		
Jan.	46,692	256,640
Feb.	45,036	268,160
Mar	43,736	221,440
April	30,535	203,620
May	49,734	232,320
June	46,642	227,840
July	41,000	200,320
Aug.	43,913	213,120
Sept.	39,492	191,760
Oct.	41,533	206,080
Nov.	37,541	218,240
Dec.	40,896	219,520
1934		
Jan.	42,794	266,240
Feb.	41,916	285,440
Mar.	48,157	240,640
April	39,284	223,360
May	39,815	199,680
June	51,150	240,000
July	50,933	235,520
Aug.	51,752	242,560
Sept.	49,195	217,600

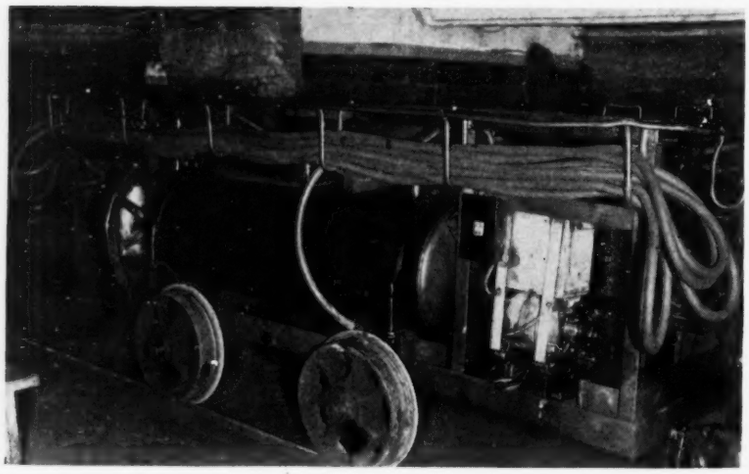
Dating From May, 1933, Maintenance Cost at Fairpoint No. 9 Mine Increased Due to a Drive to Improve Equipment. Failures, However, Decreased, and Within a Year Equipment Condition Was Improved to the Degree That Maintenance Cost Also Began to Drop.

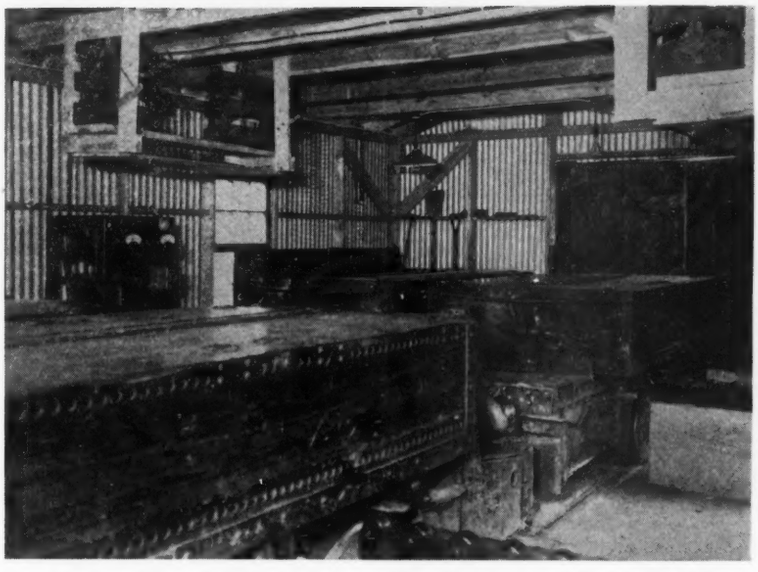
At Lafferty No. 6 mine and at Fairpoint No. 9 the machine shops are located inside. The shop of the latter, the mechanical mine, is located about 1½ miles from the portal and includes the following equipment: 24-in. x 7-ft. lathe, 24-in. heavy-duty shaper, 300-ton hydraulic press, 18-in. drill press, and emery grinder.

It is the policy to encourage technically trained men to take jobs in the maintenance department. At present two of the workmen, one a machinist and the other an electrician, are college-trained engineers. Instead of buying all repair parts many items are made in the shops. It is considered that buying all parts ready made has the disadvantage that there is little chance to train maintenance men to the proper appreciation of the closeness of fits required for precision equipment. Making parts in the machine shops develops the careful workmanship desired. Hence it is considered better to make certain parts even though in some cases the apparent saving may be small.

Lubrication is accorded its rightful first place in equipment maintenance. In line with the latest practice at a number of mechanical mines, lubrication of the loading machines at Fairpoint No. 9 mine is handled by a special crew

Grease Buggy Used to Lubricate Cutters, Loaders and Locomotives.





Battery Charging and Maintenance at Piney Fork No. 1 Mine Is Facilitated by a Well-Equipped Barn Located Outside at a Drift Opening and Close Beside a Fan and Substation, so That One Man Can Tend All Three.

equipped with a "greasing buggy" which has all the facilities to promote thorough and rapid lubrication of equipment, including mining machines and locomotives. The buggy carries a 60-gal. tank for motor oil, another of the same size for mine-car oil used for greasing items such as cutter chains, and also a Lincoln power-driven lubricator with 20-gal. grease reservoir. Other equipment on the buggy includes a motor-driven air compressor and air receiver for blowing dirt from equipment and for forcing the oil from the tanks. Automatic control is provided to maintain the air pressure at 40 lb. and the greasing unit also is fully automatic.

The greasing crew also acts as an inspection crew to report all items which show a need for maintenance attention. In order to make this inspection as effective as possible, it is the policy that one man of the two forming the crew shall be an experienced maintenance electrician. This policy also has its effect in securing a more thorough greasing job. Time of the greasing crew is charged on a fixed prorated basis to the various items of equipment, but the time of each maintenance man is charged on his time card each day to the specific items of equipment on which he worked.

Mining-machine cutter-bit practice is now undergoing a change which is expected to reduce cost and increase tonnage per machine. The tipping of bits with hard materials has been tried, but, due to a local condition, it was abandoned. There was a tendency for the welded bit points to break off when they encountered iron pyrites, locally termed "copper stone." High-carbon steel stock is used for bits. The new practice being tried is to quench the entire bit from a temperature of 1,250 to 1,600 deg. F. in water after hammer-forging the new point. Next the temper is drawn by immersion for an hour or so in oil at 400 to 425 deg. F.

Mining-machine jaw clutches, which have been an item of high maintenance, are now being faced on the wearing surfaces with Stellite. Unless some unforeseen difficulty shows up after long usage the method will practically eliminate one more of the recurring difficulties that have been attacked. Armature failures in a mounted-type cutting machine were cut down by adding blowers, which decreased the motor temperature rise from an excessive figure to 22 deg. C. These blowers were applied one year ago, and there have been no armature failures since. Before the change some of the armatures lasted less than 30 days.

Solid gears only are now being purchased for locomotives. Existing split-gears with teeth in good condition are being welded along the split and in the bore, and machined for application to the axles by hydraulic press. The use of steel tires, turning them to restore proper contour, and junking them after they get thin, is the locomotive-wheel practice followed. A considerable improvement in locomotive performance was attained by correction of wheel gages to allow proper clearance for tire flanges. It had been the practice to widen the wheel gage beyond standard with the idea of helping keep the locomotives on the tracks. As tracks were improved and steel ties adopted, rails were held closer to the 42-in. gage, and this had the effect of causing the locomotives to run tight and flanges to wear rapidly. Now all wheels are mounted with the distance between flanges $\frac{1}{2}$ in. less than the gage between rails.

Maintenance of mine-drainage equipment has been reduced by changes in pump controls and by installation of acid-resisting pipe. At Lafferty No. 6 mine, the water is highly acidulous; at Dillonvale No. 1 it is somewhat less corrosive; at the Piney Fork mines it is slightly corrosive, and at the Willow Grove mine the water apparently contains no acid. Approximately 1,000 ft. of Bermico fiber pipe and some wooden pipe has been installed at Dillonvale No. 1; Lafferty No. 6 already has 3,400 ft. of Bermico and another 3,000 ft. of the same make of pipe is now being installed. Some wooden pipe is in use at the Piney Fork mines. One pump-discharge borehole at Lafferty No. 6 is equipped with Ace rubber-lined pipe, and a more recently installed borehole is fitted with Bermico pipe.

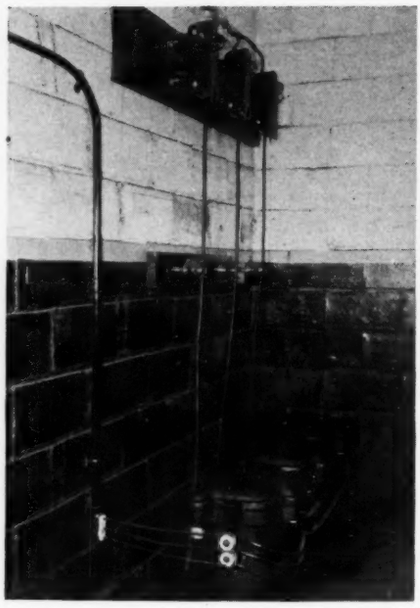
Near the shaft bottom in the Lafferty mine there is in use a double-unit two-stage centrifugal pump made by the United Lead Co. This is equipped

Equipment of a Drilling Crew Includes an Emery Grinder for Sharpening Augers.

with Monel metal shaft and impellers. The brass seats of the old reciprocating pump that it replaced had to be renewed every few days. Indications are that the average life of the Monel impellers will be over five years. Equipping the d.c. pump motors with automatic starters made by the Ohio Brass Co. has materially reduced starter and motor maintenance.

Armature rewinds of practically all d.c. equipment, such as mining machines, loaders and locomotives, are done with asbestos-insulated wire. Coils made of this type of wire and properly insulated with mica to assure ample dielectric strength have proved far superior to cotton-insulated coils for equipment that is liable to reach high operating temperatures. To reduce maintenance of substation equipment, sets have been equipped with bearing thermostats and the control boards fitted with contacts, relays and breakers to protect against the damaging conditions that may arise with equipment operating in parallel.

Freedom from maintenance was a prime consideration when recently in the Willow Grove No. 10 mine over two miles of a.c. 4,000-volt armored cable was installed underground in trenches along haulways to feed a new substation and a fan motor. It is expected this cable will be practically free from the maintenance that would have been required for an outside pole line and also that the substation motors will be free of the maintenance that lightning might cause if the units were fed by a pole line. Equipments fed by 4,000 volts and 2,300 volts are serviced through General Electric porcelain explosion-type fused cutouts and protecting relay on oil breakers to take care of the 4,000-volt cable. Improved lightning-arrester equipment has reduced lightning damage this last season as compared with the season before.



Porcelain, Explosion-Type, Fused Cut-Outs on 4,000/220-Volt Control and Shop Lighting Transformers in No. 9 Mine. Freedom From Maintenance Is the Aim in Making New Installations or Changes to Electrical Equipment.

For reconditioning insulating oils the company owns a portable oil dryer and filter with electrically heated drying oven for the filter paper. The capacity is 10 gal. per minute and the pump is powered by a 1½-hp. motor. This equipment is transferred to the various mines as needed.

In the supervision of maintenance, operating conditions affecting equipment are not overlooked. As an example, it is a well-known fact that the number of starts and stops has a material effect on equipment, especially on certain electric equipment that is not built primarily for such duty. For this reason cooperation of the operating department was secured in reducing the number of starts of tipple and cleaning-plant equipment. Direct-current voltages feeding inside equipment are not allowed to drop to values that will appreciably increase the heating of equipment. At intervals not exceeding six months a complete check is made of loads and circuit sizes and substandard conditions are immediately remedied.

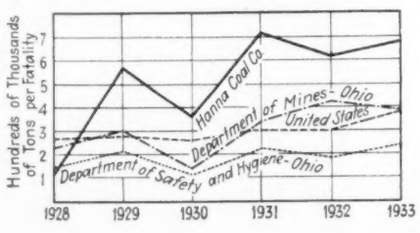
SAFETY

+ At Hanna Coal Co.

"OF ALL MINES, those with a bad roof have the best safety record." This saying is well on its way to be a proverb. But while, like many proverbs, it is probably not always true, the record of the Hanna Coal Co. might well be advanced to sustain it. The mines of this company are all in the Pittsburgh seam, which everywhere has an unsafe roof. And of all manifestations of that seam the worst are those in Ohio and the Panhandle of West Virginia, where the Pittsburgh seam takes the Ohio Geological Survey's designation "No. 8." In general in Ohio, it is customary to call the seam the "Pittsburgh, or No. 8 seam," or, more shortly and incorrectly, the "Pittsburgh, No. 8."

The soapstone or clod over the seam is extremely uncertain. Sometimes it comes down with the coal up to a "wild" or rider seam above, and sometimes it stays in place for a greater or lesser length of time and then falls. Knowing this characteristic, it is always barred down or shot. Fortunately, as it is well known to be dangerous, men do not take chances with it and are not satisfied till it is on the floor of the mine. The rider seam is of varying thickness from 10 to 24 in., is high in sulphur and valueless as fuel, but it makes good top, even though it varies greatly in hardness. Above the coal is several feet of a mixture of shale and limestone surmounted by more limestone. If the coal is not secured by timbers in due time, the roof may continue to break down till solid limestone is reached.

Fig. 1—Tons Per Fatality Record of Hanna Coal Co., State of Ohio and United States, 1928-1933.



Safety consists in sizing up the hazard to be met and meeting it betimes, and the condition at these mines is so variable that the employees take no chances. A standard for timbering is set at every Ohio mine, applicable solely to the conditions at that mine. This is a minimum standard. The miner may use more timber at his discretion and his foreman or the foreman's assistants may order more timber to be set if they

Mass Safety Meeting at Dillonvale. This Meeting Celebrated the Award of the Ohio State Safety Record.

think it needed, but less than the established minimum must never be set. Props are 4½ in. in diameter or its equivalent at the small end. Forty per cent of the posts supplied must be round. Methods of propping are described on pp. 457 and 459 of this issue.

The safety program of the Hanna company heads up in an executive safety meeting which is held each month. At this session the general manager presides and the superintendent at each mine, the safety director, the mining and electrical engineers are present. R. L. Ireland, Jr., executive vice-president, is a member. The minutes of each meeting are sent to him at Cleveland. At these meetings are reviewed the minutes of the monthly meetings at each mine whereat, in turn, are present the superintendent, foreman and underbosses, the clerks and a loader or machineman from each section. At executive meetings, the engineering department also makes a report. All engineers, in going on their duties through the mines, are required to note all dangerous places and practices they observe and these are reported monthly to the vice-president in charge of operations, who also is general manager, which reports are read at the monthly meeting. To any defect in safety reported the superintendents have to make reply. All the monthly local mine reports on safety are made in triplicate; one goes to the safety director, one to the executive vice-president and one to the vice-president in charge of operations. The safety director's copy has to be initialed by the last, who returns it for filing.

A mass safety meeting at the mine mouth or inside in the man-trip has

Table I—Fatality Record of Hanna Coal Co. of Ohio, Oct. 1, 1934

Mine	Date of Last Death	Cause of Fatality	Tons Produced Since Last Fatality	Man-Hours Worked Since Last Fatality
Dillonvale No. 1	Aug. 31, 1933	Transportation	242,968.65	336,306
Lafferty No. 6	July 11, 1931	Transportation	940,951.60	1,303,459
Fairpoint No. 9	June 15, 1933	Fall of stone	856,105.00	743,215
Willow Grove No. 10	No deaths since Jan. 1, 1934, when Hanna Coal Co. took charge		297,483.95	465,134
Piney Fork No. 1	Nov. 17, 1930	Operating cutting machine	809,256.10	1,204,218
Piney Fork No. 2	June 5, 1933	Fall of stone	1,088,494.45	1,540,158
Total, Hanna Coal Co. of Ohio (all mines)	Aug. 31, 1933	.....	2,813,352.10	3,401,998

Table II—Tons Mined per Fatality in the United States, in Ohio and at the Hanna Mines

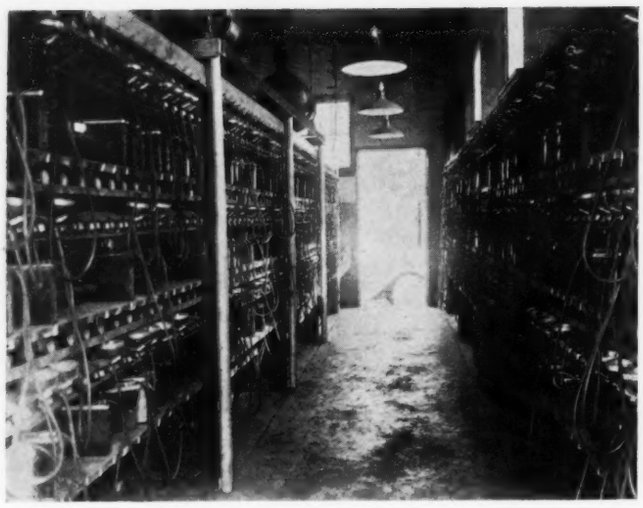
	Tons Mined Per Fatality					
	1928	1929	1930	1931	1932	1933
United States	264,749	278,380	260,257	301,949	297,899	372,497
Ohio { Dept. of Mines	228,288	300,372	144,024*	340,383	421,952	384,615
Ohio { Dept. of Safety and Hygiene	144,876	214,154	111,856*	224,428	185,659	235,294
Hanna Coal Co	108,166	572,181	356,343	712,360	616,866	673,158

*Millfield explosion.

Table III—Accident Record, Hanna Coal Co. of Ohio, 1928-1933

	1928	1929	1930	1931	1932	1933
Tons Mined	540,831	1,716,542	2,138,059	2,137,079	1,233,733	2,019,475
Number of compensable accidents	89	231	240	100	71	96
Number of medical cases only	148	320	190	95	64	44
Number of fatalities	5	3	6	3	2	3
Total accidents	242	554	436	198	137	143
Cost of total accidents	$86,746.38	$85,829.82	$106,725.04	$93,984.71	$46,250.43	$39,068.91
Cost of accidents per ton	0.160	0.050	0.049	0.044	0.035	0.019
Cost of accidents per $100 payroll	13.11	5.40	5.13	4.96	5.36	2.95
Number of man-days (8 hr. per day)	.....	321,005	395,739	371,888	211,663	356,364
Compensable accidents per 1,000 man-days	.....	0.719	0.606	0.269	0.335	0.269
Medical cases per 1,000 man-days	.....	0.997	0.480	0.255	0.302	0.123
Total accidents per 1,000 man-days	.....	1.726	1.102	0.532	0.647	0.401
Tons produced per accident	2,235	3,098	4,904	10,793	9,005	14,122
Tons produced per fatality	108,166	572,181	356,343	712,360	616,866	673,158
Cost of administration of safety department	$4,160.00	$4,200.00	$4,127.15	$9,339.98*	$4,834.13	$5,390.35
Cost of administration per ton	0.0076	0.0024	0.0019	0.0043	0.0039	0.0027
Cost of administration per $100 payroll	0.63	0.26	0.19	0.49	0.56	0.41

*Picnic of all employees and their families charged to safety department.



Lamphouse Serves Both Piney Fork Mines.

Lamphouse at Willow Grove No. 10 Mine.

been held at each mine once a month for five years. The men assemble five to fifteen minutes before the shift, when they are addressed by the safety director, for whom a stand has been erected on the hillside outside each mine. The mine workers quite readily assemble for such talks, of which they are notified in advance by the mine foreman. The address ends abruptly at the blowing of the whistle.

Any underboss, none of whose men has been hurt for one month, gets $2. If during a period of six months none of his men have a lost-time accident he receives $25 additional, and if he completes the year without any men in his charge having such an accident he receives a further sum of $50. The superintendent and mine boss of the mine that has the best record during any calendar year each receives a suitably engraved watch. The yearly record of each underboss and foreman is presented to the vice-president in charge of operations with the compensation costs that have been incurred under his management added to his salary, to show the real cost to the company of his services. This puts the matter in a new light, as some of the men are thereby shown to be expensive men for the company to employ.

In case of an accident, the conditions and cause of the accident are fully determined and these are published at the mine with the name of the man involved, also the name of the foreman and the name of any man having authority over him at the time of the accident.

Where a section of a mine goes a month without a lost-time accident, cigars are sent to the mine to be distributed to the men by the section foremen. A safety flag is hoisted at all mines beneath the American flag and remains in position until a lost-time accident occurs, when it is taken down and not hoisted again until the beginning of the following month. A safety admonition of some kind, such as "Safety" in large letters, is displayed at the mouth of each mine and often in other available points.

The company's attitude toward safety clothing has been that it should rest not on compulsion but on persuasion and experience. However, safety shoes are compulsory at all mines and all the men now wear them. Safety hats, which are badly needed, are not yet compulsory equipment, but a large percentage are being worn. No cloth miners' hats are being sold in the company's stores, and new men being hired are asked what kind of hat they will wear. About 50 per cent of the men wear goggles. They are of different types and are bought at the stores. None are prescription lenses. But the continued emphasis on the eye hazard by the company has made the men reflect on the hazard, and accordingly they buy and use goggles or at least exercise discretion so that the eye hazard has decreased, even without compulsion.

As regards gloves, the company has made no decision. Many of the men are using cotton gloves when they need them. Some nip their fingers when using hand augers, making them subject to infection. The importance of some hand protection is well indicated by the fact that 25.37 per cent of all accidents at all the company mines occurred to hands and fingers, being next in frequency to foot and leg accidents with a rating of 31.35 per cent.

A careful medical examination is made of all men to ascertain their condition. This reveals any predisposition to accident and also uncovers diseases that may weaken the employee or cause him to infect others or again make him dangerous to other men. Some men have conditions which if incurred in industry would be compensable. These conditions may be aggravated by work or may later be charged by the workman to the work he has performed, enabling him to collect for them, though not due to his present employment.

Table IV—Comparison of Estimated Experience With State Fund Experience of the Hanna Coal Co. for the First and Last Six Months of 1933

First 6 Months	Tons Mined	Estimated Cost of Accidents	Estimated Cost Per Ton	Cost Per Ton On Basis Paid to State	Premiums Paid State Based on $100 of Payroll	Actual Estimated Cost Per $100 Payroll	Cost Per $100 Payroll On Basis Paid State	Base Rate of State
Dillonvale No. 1	243,434.65	$5,499.29	0.023	0.029	$7,021.20	$3.94	$5.03	$7.50
Lafferty No. 6	44,495.45	119.42	0.003	0.031	1,359.45	0.44	5.03	7.50
Fairpoint No. 9	262,375.20	12,196.32	0.046	0.023	5,907.22	10.39	5.03	7.50
Piney No. 1	1,136.55	0.00	0.000	0.058	65.90	0.00	4.84	7.50
Piney No. 2	364,433.50	6,318.52	0.017	0.029	10,784.17	2.84	4.84	7.50
Total	915,875.35	$24,133.55			$25,137.94			
Average			0.026	0.027		4.75	4.95	....
Last 6 months								
Dillonvale No. 1	232,290.90	$2,367.26	0.010	0.053	$12,381.83	$1.34	$7.03	$9.50
Lafferty No. 6	181,831.80	5,487.11	0.030	0.053	9,615.37	4.01	7.03	9.50
Fairpoint No. 9	244,375.28	4,304.76	0.018	0.041	10,135.75	2.99	7.03	9.50
Piney No. 1	46,795.90	177.21	0.004	0.069	3,267.33	0.38	7.03	9.50
Piney No. 2	398,306.40	2,599.33	0.007	0.055	22,071.50	0.83	7.03	9.50
Total	1,103,600.28	$14,935.67			$57,471.78			
Average			0.014	0.052		1.83	7.03	....
Total per year	2,019,475.63	$39,069.22			$82,609.72			
Average for year			0.019	0.041		2.95	6.23	

The examination gives the company an opportunity to require that the newly engaged employee acknowledge the presence of a hernia so the facts can be presented to the Industrial Commission in case of disablement from aggravation of such a condition. Wax in the ear often is of such nature as to make the man who develops such wax entirely deaf, especially when coal dust settles on such accumulations. Vision has been found so impaired that there seems reason for requiring in many cases prescription lenses for these men. In all cases of badly impaired vision the men are required to go to a specialist and bring back a report. If the report is very bad they are rejected. Men who up to that time had not realized the defects of their eyes often buy spectacles. Protective shoes, hats and goggles have been found by the Hanna company so to appeal to the common sense of the employees and to add to their comfort, where properly adjusted, that they work their way into the mines, and the men are willing to buy and use them if drastic enforcement is not too early applied.

Only new employees receive medical examination. Many men are ignorant of their physical defects and by examination learn for the first time how to take care of themselves and how to provide themselves with protective equipment, such as trusses, against the aggravation of such conditions.

Effort is made to convince the men that good miners do their work the safe and effective way, that safety methods of operation are evidence of skill in their craft and that they should be proud to exhibit skill in the avoidance of accident. Protective clothing is a mining tool that every good miner should use and display. He should be as proud of having safety equipment as a carpenter is proud of having a good kit of tools, especially as safe shoes and hats are more durable than the other kind and prescription goggles are a source of as much satisfaction as safety.

Electric lamps are used at all mines except No. 1, which will soon be finished. In all there are 1,798 Wheat lamps and 395 Edisons, two hundred of the former being of the improved Model Q type. They serve incidentally as a means of checking the men as they go into and leave the mines. The mine authorities hold that they give an inexpensive, steady and good light, which the men appreciate. Though primarily installed for efficiency, they give added safety by reason of their strong, continuous illumination.

Only one fire of importance has ever occurred in the mines and this was on Nov. 30, 1931. It was extinguished by direct fighting, the same day, the fire being dug out. It occurred in a manway from unknown causes and involved both coal and timber. None of the mines are rock-dusted. In this connection, it may be said that the mines are shallow and moist and free of gas. The valleys are bathed in fog during most nights, so the air entering the mines is well dampened.

An enviable record for safety has been established at these mines, as Table I evidences. A chart (Fig. 1) and Table II show the record of tons per fatality for the United States, for Ohio as recorded by the Department of Mines and as tabulated by the Department of Safety and Hygiene, and for the Hanna Coal Co. This gives clear evidence of the value of the safety work. In 1928, the year before the present safety campaign was instituted by the

Safety-First Board at Fairpoint Mine.

Hanna company, the number of tons per fatality was lower than that for the bituminous coal mining industry of the United States as a whole or for the State of Ohio. The next year and in all succeeding years, the tonnage per fatality was much higher than in the United States in general or in the State in which the Hanna company is operating. Thus a bad record in 1928 was replaced by a good record in 1929, a less good but favorable record in 1930, and an even better record than any of the three in 1931, 1932 and 1933. Table III shows the experience of the Hanna Coal Co. from 1928 to 1933.

Cost of administration of the safety department covers the supervisory cost of accident prevention and the cost of caring for cases, such as interviews, attendance at hearings in court and before compensation boards after accidents have occurred. Strictly speaking, these should not be charged to accident prevention. In the first group are that part of the safety director's and stenographer's salaries and expenses, apportioned to accident prevention proper, first-aid supplies, safety, cigars, prizes, awards and bonuses, printing, safety flags and emblems and membership in safety organizations. This cost in the first three months of 1933 was $875.20. The second group covers the rest of the safety director's and stenographer's salaries and expenses and printing cost, or, for the first three months of 1933, $1,011.52.

Figures have been prepared showing the number of fatalities in the State of Ohio by both the Department of Safety and Hygiene and by the Department of Mining. The divergence is considerable. Without quoting these at length it may be said that in 1932 the first shows 75 fatalities and the second only 33. In 1933, the figures given by the first show 85 fatalities and by the second 52. The Department of Safety and Hygiene is interested in every reported death; the Department of Mines interests itself in actual deaths caused by accidents. A large part of the divergence arises from the fact that many accidents reported as disabilities or not reported at all end in fatal results. Then dependents long after the event obtain compensation for the death of the person injured.

Septic conditions have an important bearing on the fatality rate, and the Hanna Coal Co., by having its medical men present at the emergency hospital, which is close to each mine portal, at the end of the day's run to sterilize wounds and perform other ameliorative treatment, manages to prevent many injuries from becoming serious or even resulting in fatalities. Every foreman, also, has a bottle of merthiolate with him for sterilization of injuries; and first-aid packages are distributed to all the key men and are placed around the mine under lock and key, so as to be available for use in case of need.

Table IV shows the savings made by self-insurance and by operating on a basis that prevents accidents. Note that the base rate of the State has gone from $7.50 to $9.50 for the last six

Table V—Accidents by Nationalities

Nationality (1)	Number Injured (2)	Percentage of Total Accidents (3)	Percentage of Total Employees (4)	Relative Liability to Injury (3) ÷ (4) (5)
Polish	20	29.85	20.26	1.47
American	21	31.34	23.16	1.35
Hungarian	5	7.46	5.56	1.34
Others	21	31.35	51.02	0.61

Table VI—Accidents by Age Groups

Ages of Employees, Years Inclusive	Number Injured	Per Cent Injured
18–25	15	22.38
26–35	11	16.42
36–45	19	28.36
46–55	17	25.37
56–65	3	4.48
66–75	2	2.99
18–75	67	100.00

Table VII—Accidents by Part of Body Affected

Nature of Accidents	Number	Per Cent
Eye	5	7.46
Hands and fingers	17	25.37
Head	5	7.46
Foot and leg	21	31.35
Body	7	10.45
Hip and pelvis	3	4.48
Hernia	5	7.46
Back	4	5.97
Total	67	100.00

months of 1933, and that the actual cost of accidents of the Hanna company has dropped from $4.95 to $1.83 per $100 of payroll.

Studies were made during the first half of 1933 into the proneness of persons of the several nationalities to accident, but, in view of the shortness of the time covered and the limited number of men of any given nationality and the fact that many Americans were born in other countries and have been but a few years in the United States, it is not safe to draw any conclusions. Table V therefore is interesting but by no means conclusive. Moreover, figures which are not based on men engaged in the same class of work are misleading. Some men are likely to have day-work jobs and others are miners, and it has not been decided whether mining or company work is the more hazardous. Besides, some miners are working with machines and some by hand. The unquoted nationalities as a group have a relative liability to injury of 0.61, but one nationality among them runs much above any figure quoted in the fifth column. This nationality has not been listed because of the few accidents in aggregate sustained. Some nationalities were entirely free of accident.

Table VI shows liability to accidents based on age of employee and is also taken from records for the first six months of 1933, but the percentage of employees in any age group is not available.

Another tabulation (Table VII) was made for the same period based on the location in which injury occurred.

An award of a certificate of honor was made to the Hanna Coal Co. by the Joseph A. Holmes Safety Association on March 5, 1934, for having reduced accidents year by year from 554 in producing 1,591,297 tons of coal in 1929 to 143 in producing 2,019,476 tons in 1933, accident frequency being reduced 75 per cent. The award includes the five properties of this company and its subsidiary, the Jefferson Coal Co.

Dillonvale No. 1 received from the Industrial Commission of Ohio a certificate of safety merit in recognition of a best group accident prevention record in the safety campaign extending from April 1 to Sept. 30, 1934.

But safety is not the only advantage of those employed by the Hanna company. The participants, male and female, of the Hospital, Medical and Burial Association have a death rate of a little less than five per thousand persons, whereas the average death rate for Ohio is 10.4 per thousand.

VENTILATION

+ At Hanna Coal Co.

TO KEEP the cost of ventilation of the Hanna mines at a minimum without impairing the quality of the air, the latter is made to travel in a single direction wherever possible, so that it does not discharge at or anywhere near the point of entry. By using this system, less entryway has to be maintained and the friction of the air is thereby reduced.

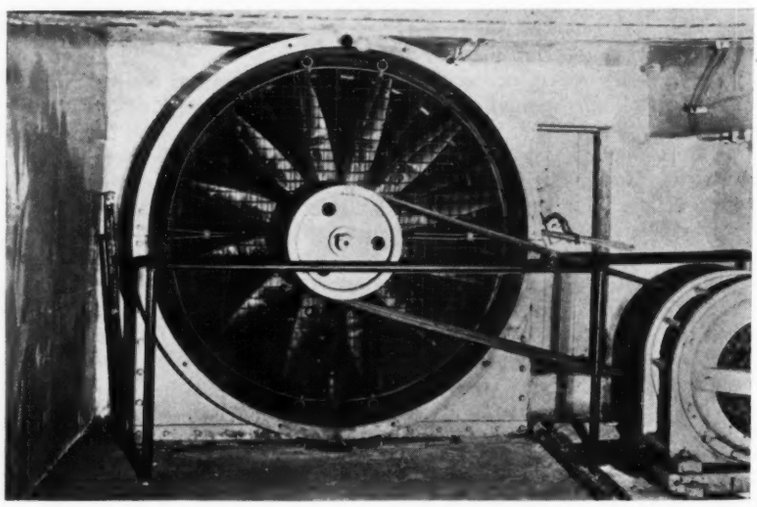
Ventilation is regarded by the Hanna company as a rapidly varying problem to be met by new expedients whenever and wherever conditions change. When the monthly ventilation reports indicate a change in the water gage, an investigation is made to determine whether a change should be made in the fan or within the mine. In this way ventilating costs are decreased.

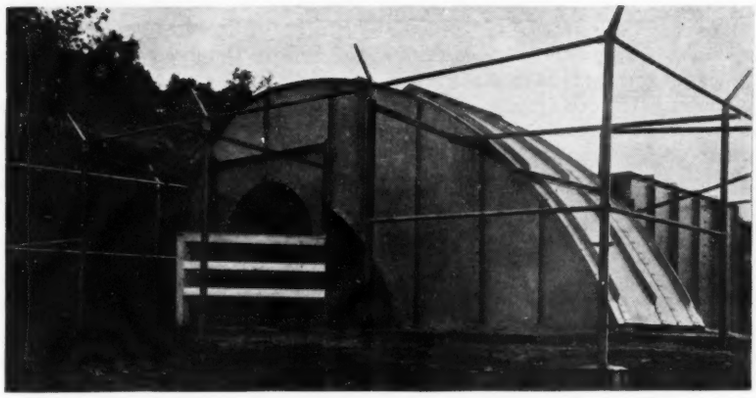
Dillonvale No. 1, which is pulling pillars, is ventilated by a 7x3½-ft. double-inlet belt-driven blowing fan powered by a 50-hp. slipring motor with drum control. This fan is located at the mine mouth, and the air is forced along both headings of the main entry to 3 and 4 North Faces, where the air leaves the mine through 19 and 20 Left. This fan is now producing 58,000 cu.ft. of air per minute at about a 2-in. water gage.

The fan at the Lafferty mine is located at an airshaft (120 ft. deep) approximately 3,000 ft. from the hoisting shaft. In some parts of this mine the air has to double on itself, with the airway as the intake and the roadway as the return. The ventilation at this mine is obtained from an 8-ft. Robinson belt-driven fan of the blowing type, producing 70,000 cu.ft. of air at a 3-in. water gage and consuming approximately 52 hp., with a fan efficiency of from 72 to 74 per cent. It is driven by a 60-hp. 2,200-volt slipring motor. About a year ago this belt-driven fan replaced an old fan wheel, with a resultant saving of about $250 per month.

The fan at Fairpoint is located at an airshaft (85 ft. deep) located about 6,000 ft. from the pit mouth. It is a 72x36-in. blowing unit with a Texrope drive and a 75-hp. 2,200-volt slipring motor. The air current goes through the mechanical workings by intakes and returns, but the main motor road and what was the original return are now both used for the return current. As this 75-hp. motor is greatly underloaded, a 40-hp. unit is being installed in its place

Fan at Piney Fork No. 1 With Propeller-Type Blades.





Backward-Bladed Centrifugal Fan at Willow Grove No. 10.

to increase the power factor and the efficiency of the installation.

At Willow Grove the fan is also located at an airshaft 50 ft. deep and about 5,200 ft. from the mine mouth. This is a new Robinson double-inlet, backward-bladed, 7x5-ft. force fan, which produces 70,000 cu.ft. of air per minute at a 3-in. water gage. It has a 50-hp. motor and a Dayton Cog-Belt drive. The new location is approximately at the center of the workings. This mine, having many years yet to run, has been extensively gunited, so that hereafter the air will have no destructive effect on the roof and the airways will be clean at all times. All new face entries in this mine will have four headings in pairs. The left pair and the right pair will each consist of an intake and return; later, one pair will be used for intaking and the other pair for return air. In this way an almost solid pillar ultimately will be available between intakes and returns, and leakage will be reduced to a minimum.

At Piney Fork No. 1 a two-stage Jeffrey Aerovane force fan, 6 ft. in diameter, with Timken roller bearings, has been set in an airway 250 ft. from the aircourse opening. It is operated by a 50-hp. 440-volt motor and a Texrope drive. This fan is located about 2½ miles from the mine mouth. About 50,000 cu.ft. of air per minute is driven through the mine by this fan, with a consumption of 33 hp. and with a fan efficiency of 70 per cent. This fan replaced two ventilation units, one powered by a 20-hp. d.c. motor and the other by a 50-hp. d.c. motor, thereby resulting in a monthly saving of between $250 and $300 per month.

Piney Fork No. 2 mine has three blowing fans powered by 30-hp. d.c. motors. As the life of this mine is very short, the d.c. drives were left on the fan, the necessary expenditure needed to build a.c. power lines not being justified.

Hanna standardizes on permanent cement-block stoppings and temporary brattice-board stoppings, and in a proper maintenance of airways, use of gunite to protect the roof against the intake air, the placement of ventilating fans as close to the workings as possible, and the use of fans suited to the work to be performed and having a high efficiency.

DRAINAGE

+ At Hanna Coal Co.

IN THE MAIN, drainage at the mines of the Hanna Coal Co. is a matter of gathering water from working faces and sumps. The coal bed lies on a gentle slope of 25 ft. to the mile, or 0.5 per cent. As rooms in the hand-loading mines turn half in one direction and half in the other, the half that go to the dip need pumps if they develop water, which they rarely do. With roadways laid on the top of the fireclay bottom, any depressions in the floor—and a few occur—necessitate the installation of a pump to remove water. This water is sometimes quite acid. Willow Grove, Fairpoint and Dillonvale No. 1 are driven to the dip; Piney Fork No. 2 is mostly to the dip, and only Lafferty and Piney Fork No. 1 go to the rise.

It is difficult to explain the acidity of the water, except perhaps at Lafferty, because the coal shows little signs of the efflorescent pyrite so common in most mines along the weathered coal face, and because the roof contains such a large quantity of limestone that the water entering the mines should be extremely alkaline. At Lafferty, however, the water of the mine was pumped back into the old dipping workings so that these contain much standing water to which the air has access—a condition peculiarly favorable to acidification. When this water, which is not drained off, rises to a sufficient height, the excess flows into the operating area, resulting in an effluent which has an usually high acidity.

Not much water flows into the other Hanna mines, and this fact suggests that the roof is not broken to any height and that the alkaline water passes off to the surface through crevices in the lime rock and only occasionally reaches the mines. Were the whole body of water to enter the mine, it would probably result in reducing the acidity of the effluent, though the advantage of such entry into the mine probably would be problematic, for more water would then have to be pumped. In some cases, the caves break through to the surface, but even then perhaps the soft claylike material under and between the limestones may hold the water and cause it to seek an easier path to the surface through the enlarged crevices in the lime rock.

The Lafferty mine, with a shaft 107½ ft. deep, is the only mine in the group having a sump of any size. This sump measures about 15x30 ft., with water about 12 ft. deep. It is being prepared for guniting. A United Lead Co. two-stage double-unit centrifugal pump driven by a 40-hp., 220-volt a.c. motor, handles the water at this sump. The pump is equipped with a Monel metal impeller and shaft and has a capacity of 300 gal. per minute. The impeller has been in place without renewal for four or more years; prior to the use of Monel metal the life of the impeller was limited to days—or at best, a few weeks—so fast did the acid water corrode it. This pump, which is near the main shaft, dis-

charges through a 110-ft. drillhole, which is to be furnished with a 3-in. Ace hard-rubber pipe. The drillhole is of 10-in. diameter and cement mortar will be run around the pipe from its outer wall to the wall of the drillhole for protection.

Including the sump pump mentioned in the preceding paragraph, Lafferty uses eight pumping units. At one point in the mine, a Barrett-Haentjens two-stage, centrifugal, full-automatic pump constructed of Cimet has been installed. This unit has a capacity of 300 gal. per minute under a 230-ft. head and is driven by a 40-hp. General Electric d.c. motor. The priming pump has a capacity of 25 ft. per minute. The main pump just mentioned discharges through a borehole lined with a 3-in. Bermico pipe. A Murray all-wood 5x8-in. plunger pump also is used. It has wood valves and wood valve stems. It is driven by a 5-hp. d.c. motor. The other five pumps, including one on the surface, are Demings of different sizes and capacities, one 7x8-in. vertical triplex plunger pump handling 220 gal. per minute under 150-ft. head and controlled by an automatic float switch in the small sump from which its water is derived. It is actuated by a 20-hp. d.c. motor.

Some wood pipe is being used of 8- or 10-in. diameter. This was in place when the mine was purchased. Already 3,400 ft. of 3-in. Bermico pipe has been installed in the Lafferty workings and 3,000 more feet will be added shortly. Bermico and hard-rubber pipes are being used, not only because of their incorrodibility but because they do not build up on the interior and so interfere with the flow of water. In one place in the Bermico heading line, a booster pump is provided to increase the flow of water.

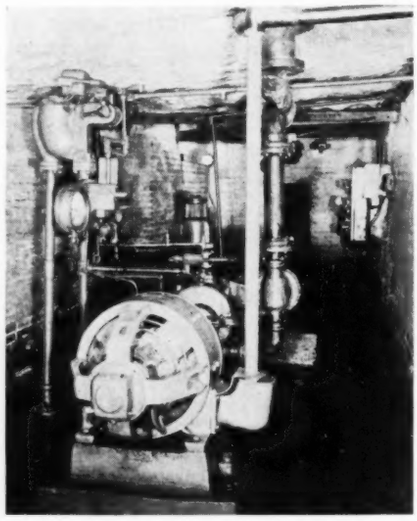
At Fairpoint, conditions are more favorable, because the workings go to the rise and the mine outcrops. Here there are only three pumps—a 5x5-in. Oilrite Deming with a 5-hp. motor, a Myers 5x10½ self-oiling pump with a 3-hp. Fairbanks-Morse motor and a Deming with a 7½-hp. motor. The large pump discharges water up an 85-ft. airshaft through a 3-in. standard steel pipe. Another pipe takes care of the water that falls down the airshaft and one is near the outside where a dip in the road has been shot until the surface of the road is level with the top of the coal bed. The water is allowed to rise until it begins to reach a point where a further rise would jeopardize the condition of the roadbed. This pump is operated only every third or fourth day.

None of the pumps is lined, not even that where the water is allowed to collect for two or more days without pumping, and steel pipe is used without undue corrosion, suggesting that the condition at Lafferty is the result of the earlier practice of pumping the water into the old workings rather than to any more natural condition. Conditions of discharge, however, do not favor either siphoning or the extension of pump discharge pipes on the surface to make use of the siphoning feature. Some of the headings approach streams, and water would enter the workings in crossing under them, but very rarely are such headings extended under the streams, and then only if good coal lies beyond; even then no rooms are driven off them, for the coal is under such weak top that the operation of rooms is not feasible.

Willow Grove No. 10 is another mine without much trouble with water, though it goes to the dip. It has a 5x8-in. single-plunger double-acting Deming pump at the bottom of the airshaft, which lifts the water 69 ft. and works only about an hour a day. This water all comes from the airshaft. Some water comes in at the slope, which has been driven to lift the coal up to the tipple. Here a Gould 4x6-in. triplex pump driven by a 10-hp. a.c. motor, takes care of the water that accumulates at this point. All of which shows that at Willow Grove No. 10 only by cutting into the rocks above the coal for some distance is water caused to enter the mine. Here is an extensive mine with 60 per cent of the coal removed and dipping from the main portal inward without a pump of any kind in the heart of the mine workings.

Piney Fork Nos. 1 and 2 and Dillonvale mines are in Jefferson County, where the measures lie well up on the hills, though not so high that the areas tributary to any mine are separated by ravines. Perhaps the light cover over these mines explains the large number of pumps and the quantity of water that has to be handled. The ready access to the surface probably explains the lack of acidity, for the water does not tarry long enough in the mine to become acidified. By the shortness of the travel the chances of water being held in a swag are greatly reduced.

This 300-Gal. Per Minute Pump at Lafferty No. 6 Is Equipped With Automatic Control.



Piney Fork No. 1 has seven pumps, four 5x5-in. Demings with 5-hp. motors, one 5½x8-in. Deming with a 10-hp. d.c. motor, one 4½x5-in. unit of the same manufacture with 5-hp. d.c. motor and a Gould pump with a 7-hp. d.c. motor. Piney Fork No. 2 has thirteen pumps. These pumps are Deming and Weinman units. Five of the first are 5½x8-in. triplex units driven by 10-hp. d.c. motors, one a triplex of similar size with a 5-hp. d.c. motor, one a single-plunger pump with 5-hp. d.c. motor. As for the Weinman units, one is a 5x5-in. piston pump with 5-hp. d.c. motor, two are 5x7-in. and 6x7-in. plunger pumps, both with 5-hp. d.c. motors, and three centrifugal pumps, two with 15-hp. d.c. motors and one with a 25-hp. d.c. motor.

Dillonvale No. 1 is an extensive mine, opened 12 years ago, and now is withdrawing barrier pillars. This accounts for the many makes of pumps in use: a Morris double-acting pump with a capacity of 600 gal. per minute, driven by a 15-hp. d.c. motor; an Aldrich plunger triplex pump of 40 gal. per minute capacity driven by a 2½-hp. d.c. motor; an Austin 5x6-in. pump driven by a 5-hp. d.c. motor and a Harris 6x6-in. pump, delivering 100 gal. per minute and driven by a 7½-hp. d.c. motor pump to the surface. The other pumps are Demings, one a horizontal triplex pump with a capacity of 100 gal. per minute and driven by a 15-hp. a.c. motor, another a 5x5-in. piston-type Oilrite pump with a capacity of 50 gal. per minute and the third a 5x5-in. unit driven by a 5-hp. d.c. motor.

All of the pumps in the three mines are used for gathering, and the water passes to the nearest crop opening still available. At one time there were no less than 35 of these openings in the Piney Fork mines, so access to the surface has been at all times short and easy. Small sumps at Piney Fork are sunk in the fireclay, which is 15 or 18 in. thick and sometimes deeper, and into the pebbly limestone bottom beneath it. Two of them are 10x15 ft. in linear dimensions and 7 ft. deep. One siphon is used at present, started by a pump which is bypassed as soon as the water runs freely. Sometimes the siphon principle is used to aid the flow of the pump.

The mines already described evidence the importance of removing water promptly from mines or keeping the air from acting on the pyrite. The really acid water seems all to be found in the drainage from the old workings of the Lafferty mine, where the Hanna company faces difficulties bequeathed from a previous administration of that mine, unacquainted with the means which have recently been developed for the control of acidification. If that administration had not pumped water back into the old workings to acidify and flow back into the main haulageways, the acidity of the drainage at that mine would have been at least less marked than it is now.

EMPLOYEE RELATIONS

+ At Hanna Coal Co.

BEYOND the major one of employer and employee, relations between coal-mining companies and their men may embrace a variety of activities, as determined by the needs of the community and the inclination of the operator. In this era of widespread contractual relations between operators and miners, the major relation between the Hanna Coal Co. and its men—that of employer and employee—naturally is governed by the agreement between the Ohio Coal Control Association and the United Mine Workers of America. Strict observance of this contract is one of the cardinal rules of the company in its relations with its personnel, supplemented by cooperation and assistance in the solution of community and social problems not covered by the contract.

The Hanna mines are located in a district with a long history of coal production behind it. A rich limestone soil and a reasonably favorable topography have facilitated cultivation of the surface and made farming a major industry in the region. Independent towns are numerous and include a number which grew up around early mining ventures since worked out or abandoned for one reason or another. These factors have been reflected in both the character of the employees at Hanna mines and in the community and social program of the company.

Average number of employees working at the six Hanna mines in the first half of September, 1934, was 2,206. Employees working by mines, as distinguished from the total on the payroll, were as follows:

	Cutters, Loaders Other Producers	Non-Producers (Day Men)	Total
Dillonvale No. 1	93	34	127
Lafferty No. 6	244	112	356
Fairpoint No. 9	191	134	325
Willow Grove No. 10	286	132	418
Piney Fork No. 1	250	129	379
Piney Fork No. 2	414	187	601
Total	1,478	728	2,206

Americans, as might be expected, constitute the largest group with 28.49 per cent of the total employees on the payroll on Oct. 15, 1934 (Table I).

Hiring at Hanna mines is in the hands of the superintendent. Applicants for positions are required to answer questions as to previous employment, experience and knowledge of shooting, handling explosives and timbering, and also are required to declare their willingness to notify the superintendent or foreman at once in case of bodily injury and contribute to the medical fund. Physical examinations, which are a prerequisite for employment, cover eyes, ears, nose, throat and mouth, teeth, tongue, neck, lungs, heart, abdomen, inguinal region, genito-urinary organs, extremities, vascular system, skin, physical characteristics, nervous system and miscellaneous defects, and include a urinalysis. Generally, only able-bodied applicants are employed, although the superintendent, at his discretion, may employ a person with physical defects on certain tasks.

Age is not a bar to employment or retention of a job, and the payroll at a number of Hanna operations is distinguished by a relatively high proportion of older men, whose work has been found to be generally satisfactory. Preference in hiring is given to experienced men, although new men are taken on in certain cases where older employees are willing to assume the task of breaking them in.

Discipline is governed largely by the provisions of the working agreement, and in cases not covered by the agreement is left to the judgment of the superintendent. Emphasis is placed, however, on insuring that each man understand his duties and the company rules, thus avoiding misunderstandings.

The presence in the region of the many independent towns mentioned above, from which all-weather roads lead to all operations, has relegated the operation of housing and community facilities to a minor rôle in the Hanna program. In all, the company maintains facilities for housing less than 20 per cent of its employees.

Renting and maintenance of housing facilities are under the direction of the mine superintendent, who is charged with the duty of keeping dwellings painted, fenced and otherwise in good condition. Farm animals and poultry are barred from villages. Residence plots usually include sufficient ground for lawns and gardens. Additional garden space is available to employees on farm land owned by the company.

Although not directly related to the question of community welfare, the Hanna Coal Co. also operates a farm department, which is responsible for the condition of surface holdings not used in the operation of the mines. This department attends to the rental of farm lands to independent farmers and also operates sawmills supplying a part of the timber requirements of the mines.

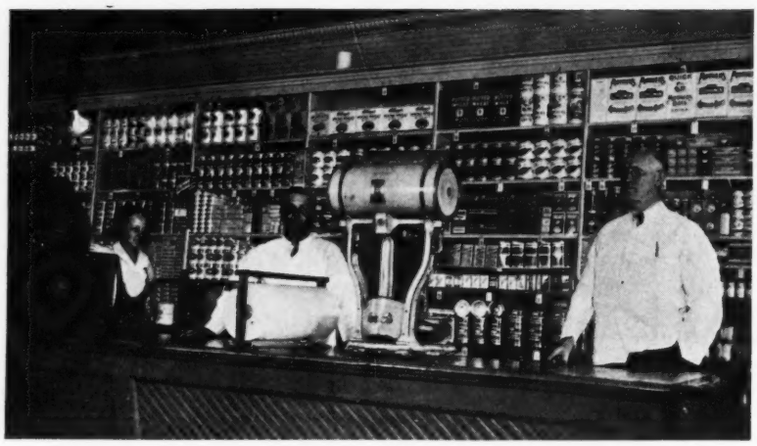
Five stores are operated by the com-

Two-Family Houses at Lafferty No. 6.

pany for the convenience of its employees at Dillonvale, Lafferty, Fairpoint, Willow Grove (opened Jan. 7, 1934) and Piney Fork. Each of these stores is in competition with independent merchants in the communities in which they operate. In one case a competitor is located within 20 ft. of the Hanna store and the farthest distance from a store to the nearest competing establishment is 2½ miles. The basic principle of operation is adherence to the stand that each store is a bona-fide retail establishment and must get its business on its merits—meaning service, quality and price.

Each store is under the direction of a manager who, subject to the direction of a general manager of stores, is expected to make the business stand on its own feet. Pressure as a means of securing an employee's patronage is definitely outlawed. This leads naturally to stores arranged to display merchandise to the best advantage, pleasant and speedy service, delivery of merchandise, and prices comparable to those of competing establishments.

Another feature of Hanna store operation is the use of charge accounts. Scrip was discontinued at all stores on April 1, 1934, not as a result of recent developments affecting the operating policies of industrial stores, but as a result of a new policy adopted two years ago. At that time, the privilege of charge accounts was extended only to monthly men, but a growing belief that more business would result if charge accounts were extended to all employees led to a decision to install the new system as soon as the necessary preliminary work could be carried out. Stabilization of labor conditions, with the resultant decrease in turnover, was a favorable factor influencing the decision.



Tags on the Shelves Show the Prices at All Hanna Stores.

Under the present plan of operation, the McCaskey or similar system is used at all stores, and in a number of cases the employee is furnished with a charge book, which is brought along when purchases are to be made. Each item, with the unit price, is entered in the book in triplicate, one copy going to the customer, another into the McCaskey register and the third to the company auditor. Collection of bills is based on payroll deductions, but the company pursues a liberal policy of deferring payments upon request for a reasonable time. Losses have been almost negligible. In addition to the convenience factor, one major advantage of this system to the purchaser is the opportunity to compare prices listed on the sales slip with those posted on the shelves and also with those charged by competing establishments. The use of legible price tags on all merchandise is a standard practice at Hanna stores.

Foodstuffs comprise the largest single item in store sales, ranging from 70 to 78 per cent of the total volume of business. Men's apparel constitutes 7 to 8 per cent; women's apparel, 4 to 5 per cent, running up to 10 per cent only at the Piney Fork store; furniture and home furnishings, less than 1 per cent; drugs and sundries, 2 to 3 per cent; and miscellaneous merchandise, largely hardware and tobacco, 7 to 10 per cent. Better grades of clothing, together with house furnishings and similar items, including luxuries, are left largely to the independent merchants in the various communities. Instalment business also is a minor item, aggregating only 5 per cent of the total. All of the stores have meat departments with the necessary cooling equipment and two have refrigerated showcases.

Merchandise includes a fair proportion of nationally advertised brands, and all products which lend themselves to such treatment are prominently displayed, each with its price tag. Each store operates a delivery truck for the convenience of its customers, and one of the delivery boy's daily tasks is a morning round of order-taking. In addition to its other advantages, the delivery system prevents standing in line at rush hours.

No survey of employee relations at the Hanna operations would be complete without mention of the unusual plan for providing medical services for the miners and their families which the company has encouraged the workers to establish. The outstanding feature of this plan is the creation of an independent agency comparable in scope to the company-doctor system in many mining communities south of the Ohio River, but under the direct control of the employees themselves. Because of this independent control, the plan has been able to meet the attacks of local medical associations that are bitterly opposed to the company-doctor idea.

Under the Hanna system, a hospital and burial association has been organ-

Table I—Employees on Payroll at Hanna Mines on Oct. 15, 1934, Classified According to Nationality, Citizenship and Marital Status

	No. 1	No. 6	No. 9	No. 10	Piney Fork No. 1	Piney Fork No. 2	Total	Per Cent
CITIZENS								
American	4	126	246	61	147	98	682	28.49
Austrian	2	42	24	30	15	16	129	5.39
Bohemian	3	2	5	15	11	27	63	2.63
English	11	6	2	14	3	3	39	1.63
German	3	4	5	33	4	6	55	2.30
Hungarian	11	6	2	6	21	40	86	3.59
Irish	13	1	...	42	3	...	59	2.46
Italian	19	48	11	13	55	112	258	10.78
Negro	8	17	5	55	13	45	143	5.97
Polish	21	66	26	58	123	124	418	17.46
Slavish	3	14	8	44	30	54	152	6.39
Others	32	29	10	76	27	28	202*	8.44
Total	130	361	344	447	452	553	2,287	95.53
NON-CITIZENS								
Italian	3	3	3	...	8	18	35	1.46
Polish	1	12	2	...	2	18	35	1.46
Others	3	7	3	3	3	18	37†	1.45
Total	7	22	8	3	13	54	107	4.47
Grand Total	137	383	352	450	465	607	2,394	100.00
Married	101	260	264	305	270	363	1,563	65.29
Single	36	123	88	145	195	244	831	34.71
Total	137	383	352	450	465	607	2,394	100.00

* Includes at various mines one or more of the following nationalities: Austro-Russian, Belgian, Canadian, Croatian, Czechoslovakian, Dutch, Dutch-Irish, Anglo-Belgian, Anglo-Irish, French, Germanc-Irish, Germano-Italian, Granish, Greek, Hindu, Italo-Swiss, Lithuanian, Montenegrin, Puerto Rican, Roumanian, Russian, Scottish, Scotch-English, Scotch-Irish, Serbian, Slovakian, Slovenian, Spanish, Swedish, Swiss, Ukrainian, Welsh, Welsh-Irish and Yugoslavian.

† Includes at various mines one or more of the following nationalities: Austrian, Croatian, German, Greek, Horvat, Hungarian, Lithuanian, Montenegrin, Russian, Scottish, Slavish and Welsh.

ized at each mine. The general purposes of these associations are: "to improve living and working conditions and the general welfare of employees and their families, and to that end establish a fund out of which medical, hospital and funeral expenses of members and their families may be paid." Membership in the association is open to all workers at the mine. The necessary funds for operation are provided by a voluntary monthly check-off of $2.50 for married men and for single men with dependents and $1.25 for unmarried men without dependents. Whenever the funds accumulated by an association reach $4,000, the monthly payments are reduced to $2 and $1, respectively, and continue at those rates until the association reserves fall to $2,000, when the $2.50 and $1.25 rates again become effective.

Expenditures from the fund are limited to: (1) the employment of a doctor; (2) payment of bills for surgical services approved by the doctor and the safety director of the company, subject to the proviso that the charges made in such bills shall not exceed those authorized in a free schedule "agreed upon from time to time between the association and the surgeon or specialist who renders the services"; (3) hospitalization on order of the association doctor subject to the same limitations applicable to surgical bills, and in neither case to exceed $500 without specific authorization of the standing committee of the association; (4) death benefits ranging from $35 for an infant to $175 for a member of the association. Where an employee or a member of his family elect to have a surgeon or specialist or go to a hospital with which the association has no contract, any additional fees over the association contract price must be borne by the employee. Finally, "no part of this fund shall be expended for or taken in lieu of any amounts for medical, nurse or hospital services or for medicines or funeral services to which the employee or his dependents are entitled under the workmen's compensation law of Ohio."

Control of the affairs of each association is vested in a standing committee of six. Four members of this committee are elected by the members of the association at their annual meeting, the safety director of the company is the fifth member, and the sixth member—also a company representative—is appointed by the general manager. Except in the matter of the selection of the association doctor and as may otherwise be specified in the association bylaws, the decision of this committee is final. These bylaws provide that the association doctor employed by the standing committee "shall be a competent physician, satisfactory to and approved of in writing by the general manager of the mining company."

Under the contract entered into by the association with the doctor, the latter agrees to render all ordinary physician's services and to perform minor surgical operations, to maintain an office properly equipped and conveniently located, to furnish all necessary drugs (except serums and antitoxins), medicines and medical and surgical supplies. Except in the case of employees residing more than ten miles from the mines, the contract also provides for necessary visits and home treatment of the employee and members of his family. In the case of employees residing more than ten miles from the mine, the doctor's obligation to make visits is limited to calls to render service only to the employee. Venereal diseases, chronic and incurable diseases, maternity cases and cases arising out of wilful act or neglect are specifically exempted from the contract.

Each mine has an emergency hospital equipped and maintained by the company, which also takes care of much of the bookkeeping in connection with the administration of the funds. The doctor is on hand each day at quitting time to attend to the men and the members of their families. In addition, the doctor is on call for the remainder of the 24 hours. Prescriptions are filled by the individual doctors from supplies kept at the emergency hospitals or at the doctors' offices.

During 1933, the records of the operation of these associations at five mines (Willow Grove No. 10 was not part of the Hanna set-up at that time) showed 6,836 day and 819 night house calls, 16,784 day and 3,701 night office calls, 5,387 emergency hospital and 749 outside hospital calls, 535 minor operations and 630 medical examinations. Four outside hospitals were used 335 times. Including the minor operations, many of which are performed in the doctor's office or in the mine emergency hospitals, a total of 886 operations were performed, ranging from simple tonsillectomies to major mastoid cases. Death benefits were paid in 29 cases and totaled $2,667. Total income for the year was $40,294.02 and expenditures were $39,297.85.

A newsy 11x14-in. 8-page monthly paper entitled the "Hanna Coal News" is published by the Hanna company. It contains news from the several mines, safety hints, records of accidents and hints as to the manner in which they could be avoided, safety poems, health suggestions, safety records, editorials, reports from the medical committee meetings, advertisements of the Hanna stores and information about elections. The publication is helpful in developing community sentiment, promoting greater safety and in improving community health.

Dillonvale No. 1—Hanna's Oldest Active Mining Community.

MERCHANDISING

+ At Hanna Coal Co.

THE "LAST WORD" in operating efficiency and equipment belongs to a dead language if the output produced cannot be marketed profitably. Ability to so merchandise is the final acid test. After the operating department has squeezed out the last mill which legitimately may be squeezed out of production costs and has added the final refinement to make the product acceptable in a highly competitive market, responsibility for the success or failure of the enterprise then shifts to the shoulders of the sales department. And only St. Andrew knows how many good golf scores have been ruined because the vision of ten cars of unsold slack clouded the sales manager's eyes as he was addressing the ball.

Full-time production bogies established by the Hanna Coal Co. call for a daily output of 12,000 tons. Reduced to its simplest terms, how to move that output is the problem which confronts the Hanna sales organization. And every time the selling force flunks on the problem, a red circle is penciled into the idle-day chart in the sales manager's office and at St. Clairsville. Not unnaturally, the sales department strives to reduce these red circles to the minimum. How, then, does the Hanna organization go about this task? What are its facilities for marketing; where does it find its greatest outlets and what competitive handicaps must it overcome? As stated in the article on management in this issue, the output of the six Hanna mines in eastern Ohio is sold by the Hanna Coal Co. of Delaware, which in turn is a sub-agent of Northern Coals, Inc. The Delaware corporation also handles certain coals from other fields on a jobbing basis, but this phase of its activities will be ignored in the present discussion.

The Hanna Coal Co. of Delaware has its headquarters in Cleveland, Ohio, with branch offices at Toledo, Ohio; Detroit and Grand Rapids, Mich. The top sales organization is headed by a vice-president and the immediate direction of the sales division comes under the jurisdiction of a general sales manager, aided by an assistant sales manager. There are three distinct branch office managers and ten road salesmen. The latter cover their territory by automobile. The cars are company-owned and the average cost of operation is between 4 and 5c. per mile on medium-sized cars and between 3 and 4c. on smaller cars.

Excluding lake shipments, approximately 90 per cent of the Hanna coal finds its markets in Ohio, Indiana and Michigan. Indiana business is handled jointly by the Ohio and Michigan branches, but each branch office and each individual salesman has definite territories for which branch offices and salesmen are held responsible. Each salesman is made to feel that he has a vested interest in his particular territory so long as he protects that interest by developing the maximum business available for Hanna coals in his bailiwick. The work of the sales force in handling industrial problems is supplemented by the services of two combustion engineers, one out of the Cleveland and one out of the Detroit office, who are qualified to make plant tests and recommendations on combustion practices. A third combustion representative is a "practical" power-plant man, loaned as the need arises from the testing and analytical division at St. Clairsville, who can go into the boiler room, don his dungarees and give a physical demonstration of correct firing methods. Detailing a man from the mines for this job has the added advantage of giving the operating department first-hand contact with some of the problems encountered by the sales department.

In common with many other fields which saw their production continuously increasing during the era of rapid industrialization of the nation which set in after the Civil War, eastern Ohio slumbered on the cushions of past glories while the rate of growth in industrial demand was slowing and competition from newer and more aggressive competing producing districts was gaining. A tradition developed that eastern Ohio and some of its Northern competitors were laggards in the race. In eastern Ohio in the last five years Hanna has taken the initiative to wipe out that tradition by the modernization program outlined in the preceding pages.

But it is one thing to know that you are good; it may be quite a different thing to sell that idea to the people with whom you want to do business. Hanna is seeking to do this necessary selling job by a course of training that puts its sales representatives in a position to discuss coal merchandising and combustion problems on a plane of intimate knowledge so that they may convince the prospect that, regardless of tradition, the product of 1934 is not that of 1920.

The first step in this training is a course of instruction at the mines, where the embyro salesman becomes personally familiar with how coal is mined, face preparation methods to remove impurities, and surface preparation procedure. He goes into the laboratory to learn how tests to control the purity of the product are conducted. This mine schooling lasts from two weeks to three months, depending upon the previous experience and knowledge of the new salesman. From the mine he is transferred to Cleveland headquarters, where he spends a fortnight learning sales office routine.

Next he is placed under the supervision of one of the combustion engineers of the company and works with the engineer when the latter is making plant inspection tests and reports. In this way he acquires a working knowledge of combustion technique and processes and a foretaste of some of the problems he will later encounter in his selling. After 30 to 60 days with the combustion engineer, the salesman is then assigned to a specific territory and, subject to the direction and help of the district sales manager, is "on his own."

Carrying the specialization one step further, industrial business is assigned to one salesman and retail trade to another. Salesmen calling upon retail coal merchants are required to make a thorough survey of retail conditions in the communities which they cover and to assist the dealers handling Hanna coals to build up a greater tonnage for themselves and for the Hanna mines. In promoting dealer activity, Hanna has rejected the idea of a blanket sales plan to be used by all distributors and concentrates on helping the dealer to prepare plans specifically adapted to the condi-

Who Wins the Decision?
The PRICE is RIGHT... The COAL is RIGHT....
9
The Experience of Users Proves . . .
The Mechanical Stoker is the Most Satisfactory and Most Economical Way of Heating Your Home . . .
if
Your Stoker is Properly Installed, Adjusted and Regulated to Burn the Proper Coal
ALL RIGHT ALWAYS!
YOU CAN'T LOSE
When it comes to firing a boiler... even a sporting proposition is out of order
HANNA COAL COMPANY
LEADER BUILDING CLEVELAND
HANNA 9 STOKER SCOTCH

A Flash at Hanna Promotional Literature

tions in his particular community. These plans take in both local newspaper and direct-mail promotion. When such assistance has been given, it devolves upon the Hanna salesman handling the account to follow through to see that the literature prepared actually goes to the retailer's customers and does not—as is too often the case with elaborate copy worked up by the mine selling organization—gather dust behind a roll-top desk in the dealer's office.

This specialized service is supplemented from time to time with mailing pieces and price lists addressed directly to the dealer. Price lists also are sent to industrial consumers, and these are to be followed up with mailing pieces giving data on analysis. Hanna also exhibits at retail conventions, where it emphasizes the Fairpoint mechanical cleaning process with a small-scale model. A special direct-mail drive on Fairpoint stoker coal for both industrial and domestic use is being made. At the present time, advertising copy in publications serving the retail dealer is used sparingly and without fixed schedules. Since the producing company is a stockholder in Northern Coals, Inc., *Northern Light*, the house organ of that sales agency, also reaches the Hanna customers.

In order to analyze the potentialities of the markets which eastern Ohio coals may reach upon a competitive basis, Hanna salesmen are making a plant-to-plant canvass of all industries in their territory. As a result of this canvass, Cleveland is building up a statistical file which will eventually show total consumption within the area served by Hanna coals, the sources of supply of each individual industrial consumer and retail user, sizes used and how business is placed. Each salesman will have the same data for his own territory. With this accurate and detailed information available, Hanna believes that its trained salesmen will be able to extend further the sale of Hanna coals in plants and to retail dealers where it can be demonstrated that such purchases will be advantageous to the buyer.

NOTES

. . . from Across the Sea

IT WILL be well to watch Germany in the forthcoming years because a great effort is being made to find substitutes for such raw and other materials as Germany cannot produce. Notable among the materials that are lacking are oil and oil products, and the most probable base for such substitutes is coal. When a nation or a manufacturer has a difficult problem, it or he will attempt developments that would not commend themselves to others who have no such problem to face. Out of such situations notable progress often is made.

So difficult is the German situation that Dr. Hjalmar Schacht, the economic dictator of Germany, has compelled lignite mining companies to unite in a syndicate with headquarters in Berlin under the control of the State for the production of motor fuel by the hydrogenation process, or by distillation—which will be chosen has not yet been decided—and it is suggested that public funds may be forthcoming to protect the lignite companies against loss. The State commission will appoint directors and execute legal contracts in its name.

But the German government also is interested in using coal dust itself for power, eliminating the necessity of deriving oil from it. Vice-Consul C. T. Zawedzki, Berlin, declares that the German Dye Trust has been making trials with a 450-hp. coal-dust engine, the largest ever built. The results of these trials, which measured the power output, efficiency and consumption of coal dust, compressed-air requirements, etc., showed that it was possible to increase the efficiency of the coal-dust motor 75 per cent, and that concurrently the heat consumption could be reduced to about 4,860 B.t.u. per kilowatt-hour.

German combustion engineers conclude that further improvement of combustion and mechanical efficiency are secondary in importance to the decrease of wear. Though tests have shown that, without means of preventing wear, the coal-dust motor wore out 10 to 200 times as fast as the diesel-oil engine, this wear can be brought within reason by the use of special materials and designs for packing, by proper handling and by lubrication with liquids or gas. But the ash problem still remains to be solved and some economical method of removing the ash must be discovered. Still, the German combustion engineers do not despair of finding a solution of this difficulty.

The German Dye Trust experiments lead the combustion engineers to conclude that the coal-dust motor already surpasses the diesel engine in its economic results. Steam turbines are far superior to coal-dust engines for base-load plants, but for peak loads perhaps the latter may be made the better engine.

At the Essen mining convention, declares *Chemical & Metallurgical Engineering,* New York, the substitution of gaseous for liquid motor fuel was said to have been technically solved. Its advantages over liquid fuel are cleaner combustion, no contamination of the lubricating oil, and instantaneous starting of the engine in the coldest weather. In Germany the following gases are available from coal distillation: methane, coke-oven gas, city gas, Ruhr gas, propane, butane, byproducts from coal by hydrogenation and petroleum cracking, replacing in all about 75,000 tons of gasoline. By rational development of existent plants, these quantities may be increased so that 200,000 tons of gasoline easily can be replaced. However, with propane and butane it is possible only to drive for 62 to 93 miles without refueling, whereas 186 miles can be traveled easily with methane and other gases. Passenger cars, says the same authority, can be driven also with butane, propane and Ruhr gas.

Among the developments which Germany is keeping in mind but is subordinating to fuels produced from coal only is the use of coal in the manufacture of what is known as colloidal fuel, the coal being ground extremely fine and mixed with oil to form a mixture with a heating value of 17,000 B.t.u. per pound—somewhat less than that of oil, which runs from 18,000 to 20,400 B.t.u. per pound. The properties and methods of manufacture of colloidal fuel were discussed at length recently by David Brownlie in a paper presented to the fourteenth congress of the Chémie Industrielle in Paris. He says that the coal is rarely ground so fine as to become truly colloidal. In consequence, certain "stabilizers," or *fixateurs*, have to be used to enable the coal to remain suspended in the oil. Sometimes peptizers, or deflocculents, are used to break up the coal and thus render it more readily suspended. Again, agitation is used immediately prior to burning, so that the mixture when fed to the furnace does not have time to separate into its component parts.

Such stabilizers are soaps of all kinds, alkalis such as sodium silicate, neutral bodies such as gelatin, glue and gum arabic, also olein oil (sodium salt and sulphonated castor oil) and stannic acid. Mostly, however, lime-resin soap has been used, the average final composition of the oil being 84 per cent oil, 10 per cent resin, 5 per cent lime and 1 per cent water. This is used in the colloidal fuel so that 0.5 to 1.5 lb. of resin is needed per 100 lb. of coal. Coal tar is used as a peptizer. It does not mix satisfactorily with oil any more readily than coal, but together they mix more freely. Thus the coal and tar stabilize each other. A typical colloidal fuel, which is not too pasty, consists of about 30 per cent coal, 10 per cent tar products, 60 per cent petroleum products, with about 1 per cent lime-resin soap as a stabilizer, although this latter is not essential.

Just as a salt will dissolve in water, so also will coal, in some slight degree, dissolve in oil, says Mr. Brownlie, the solid particles being less than 0.001 micron, or 0.000,001 mm., or 0.000,000,039 in., in size. In a colloidal solution, however, the individual particles are within a range of 0.001 to 0.1 micron, or 0.000,001 to 0.0001 mm., in size. Such mixtures in a colloidal solution will never separate on standing. A third state is suspension, and here the particles are larger than 0.1 micron, or 0.0001 mm. They can be readily removed on filter paper or on a cloth, whereas coal in the colloidal state, though it will pass through such filters, is held back by parchment, through which coal in true solution is able to pass.

When coal is pulverized in a ball or roller mill, a small part of it is fine enough for solution, more is sufficiently fine for colloidal suspension, but most of it is ready merely for simple suspension. Much of this last will separate after a few hours; hence the use of stabilizers.

Herman Plauson, an Esthonian fuel technologist, long resident in Hamburg, took out a British patent in 1913 when resident in Leningrad. He used two polished metal plates and ground the coal at high speed for one to two hours, but he found that 1 to 3 per cent of another colloid, soap, gelatin or albumen, accelerated the action. It was L. W. Bates, of New York, who added lime-resin soap to the mixture as a stabilizer, and coal-tar fractions, such as creosote, as peptizers. The fuel usually consisted of 33 parts by weight of coal, first pulverized to pass completely through a 200-mesh screen, and 63 parts by weight of heavy petroleum fractions with 1 per cent of lime-resin soap. When a peptizer was used, with or without a stabilizer, 10 per cent of coal-tar fractions was added to the petroleum. The high price of this mixture prevented its use by the British Navy, though the "Gem" utilized this product during tests under "Normand" water-tube boilers.

C. J. Greenstreet, an American, in London, later made "Coalinoil," using "oleates, stearates and palmitates" as soap, as well as paraffin wax and other wax substances. To prevent settlement he blew hot air through the liquid to thicken it by oxidation. In the "Coloil" process of George Calvert, of England, pulverized coal mixed with oil was kept

in tanks, and compressed-air equipment or other apparatus was provided to keep it in continual agitation. No colloidal grinding and no stabilizer was used, but reliance was placed mainly on agitation. The Fay process was practically the same, but the oil was kept separate, and the pulverized coal added and agitated with the oil as the product was used. This method of firing was adopted for a locomotive on the Grand Central Ry., in England, but again the cost was too great. J. W. Leadbeater used a high-grade black peat from bogs, with stabilizers such as tallow or soap. Nothing recent has been heard of this process.

Colloidal fuel also was injected by the Société Anonyme des Petroles, Houilles et Derivés into low- or high-temperature carbonization retorts or ovens to densify the solid fuel. In this process 100 parts of heavy petrol and 30 parts of pulverized fuel are mixed, and the temperature is raised to 140 deg. F. to give increased fluidity. The product was sprayed into the retort or oven while inert gas was passed through the coal.

"Fliesskohle" (flowing or liquid coal) is a product of the Maschinenbau A. G. Balcke, of Bochum, Germany. It consists of low-volatile coal suspended in coal-tar fractions, usually anthracene, in about equal proportions. No stabilizer is used and the grinding apparently is performed in a colloidal mill. No petroleum products are used, and this particularly appeals to the Germans and should appeal also to the coal industry everywhere.

R. Dawson Hall

On the ENGINEER'S BOOK SHELF

Requests for U. S. Bureau of Mines publications should be sent to Superintendent of Documents, Government Printing Office, Washington, D. C., accompanied by cash or money order; stamps and personal checks not accepted. Orders for other books and pamphlets reviewed in this department should be addressed to the individual publishers, as shown, whose name and address in each case is in the review notice.

Direct Simultaneous Microdetermination of Carbon, Hydrogen and Oxygen in Organic Substances. I—Analysis of Pure Compounds Containing Carbon, Hydrogen and Oxygen, With and Without Halogens. Contribution 17, by W. R. Kirner, Coal Research Laboratory, Carnegie Institute of Technology, Pittsburgh, Pa. 16 pp.

Oxygen is an element in coal which it is difficult to determine accurately. In all carbohydrates, it, says the monograph, "continues to be almost universally calculated 'by difference' [not by direct analysis], despite the fact that this calculation involves, especially in complex substances, the summation of errors made in the determination of the individual compounds."

The method used by Mr. Kirner, while an improvement apparently on early methods of analyzing carbohydrates, is by difference of oxygen in products of combustion and in oxygen consumed, and it is still subject to more error than is desirable, some of the oxygen in the products of combustion being derived from the supplied oxygen and some from the oxygen already in the carbohydrate.

However, ten pure substances, among which are benzoic acid, sucrose, anthraquinone and *o*-chloro-benzoic acid, have been analyzed by the direct simultaneous micro-methods for the determination of carbon, hydrogen and oxygen. Some of the compounds analyzed contained only these elements, but some contained chlorine or bromine also. The mean precision of the oxygen determination was about 0.3 or 0.4 per cent from the theoretical values. Eventually, after investigation with more complex compounds, the analysis of coal and its products by this method will be attempted.

The method is described as the complete catalytic oxidation of the substance in a stream of gaseous oxygen, the carbon dioxide and water formed being simultaneously determined, together with a quantitative determination of the "oxygen consumed." The author claims nothing new except refinements in the process. For absorption tube fillings, instead of the copper oxide-lead chromate used as part of the filling by Pregl, a 40-per-cent palladium-asbestos catalyst was used successfully. Boëtius' suggestion was followed as to the preferable absorbent for water—namely, phosphorus pentoxide deposited on pumice. Ascarite was used for absorption of carbon dioxide. Some of the happily performed analyses in the past are said to have obtained good results because of a fortunate cancellation of errors in performance of the experiment.

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International Coal Carbonization, by John Roberts and Dr. Adolf Jenkner. Pitman Publishing Corporation, New York. 453 pp. Price, $10.

This volume, as its name implies, is truly international, though with only two authors, one a fuel technologist of London, England, and the other from Oberhausen, Germany, it might be expected to lean a little toward the two countries they respectively represent, but on inspection one finds but little that is American has been overlooked. Such really international books are not readily found, and, where there are several authors, the work is rarely as well integrated.

Opening with a description of peat, lignite, bituminous and anthracitic coals, smoke and smoke abatement, it discusses conversion of coal into coke, the testing of coals in the laboratory, the thermal decomposition of coal and the formation of coke. Precarbonization treatment of coal follows, with improvement of coke quality and the petrographic study and treatment of coal. Proceeding to a study of technical developments, it describes the several low- and high-temperature processes, smokeless domestic fuel and byproducts. The authors have given the coal industry a book that brings the best information together from all sources.

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Mine Explosions and Fires in the United States During the Fiscal Year ended June 30, 1933, by D. Harrington and W. J. Fene. U. S. Bureau of Mines Information Circular 6761; 19 pp.

No gas or dust explosions have occurred during the past five fiscal years in coal mines in Alaska, Arkansas, Iowa, Michigan, Missouri, Montana, North Dakota, Texas and Wyoming, declares this bulletin. Arkansas and Wyoming had particularly bad records in the past, and during the last five fiscal years, as stated, have had no explosions. The bulletin also shows the record of explosions by States for the last five fiscal years from which Table I has been prepared.

TABLE I—AVERAGE EXPLOSIONS PER YEAR BY STATES 1928–1933

State	Deaths	Ignitions
Pennsylvania	25.0	7.2
Oklahoma	24.0	1.8
Ohio	18.4	1.6
West Virginia	18.0	5.6
Illinois	13.8	2.0
Kentucky	11.2	1.4
Virginia	11.2	0.8
Indiana	6.4	0.6
Utah	6.2	1.0
Alabama	5.0	3.6
New Mexico	4.4	0.8
California	3.8	1.2
Washington	3.8	1.0
Colorado	1.0	1.0
Kansas	0.4	0.2
Maryland	0.2	0.2
Tennessee	0.0	0.6

In the fiscal year 1932-1933 Pennsylvania had only nine deaths and six ignitions.

Explosion-ignition causes for the five fiscal years, according to the Bureau tabulations, were as follows:

TABLE II—EXPLOSION-IGNITION CAUSES FOR FIVE FISCAL YEARS 1928–1933

Ignition by	Number	Per Cent
Electricity	63	41.2
Open lights or smoking	53	34.6
Explosives	29	19.0
Unknown causes	8	5.2
All causes	153	100.00

OPERATING IDEAS

From Production, Electrical and Mechanical Men

Trench Cable Preferred Over Pole Line and Borehole

Last March over two miles of 4,000-volt Y-grounded neutral service power cable was installed in trenches along haulways inside the Willow Grove No. 10 mine of the Hanna Coal Co. This method of transmission instead of transmission by pole line and borehole was selected to reduce maintenance, lower the chances of power failure and to eliminate the likelihood of lightning damage to the 4,000-volt motors of substation equipment. A telephone cable was installed in the same trench with the power cables.

The inside substation fed by the cable consists of two 200-kw. synchronous motor-generator sets supplying 275 volts

Steel Box Protecting Main Cable Joint Sleeve. In Front Is the No. 4/0 Return Wire That Parallels the Track.

d.c., and the location is beside the main haulway 9,500 ft. from the mine portal. A branch cable connected to the main cable at a point 6,900 ft. from the mine portal extends 3,100 ft. along a lateral heading to feed a 50-hp. fan motor located at the top of an airshaft (50 ft. in depth) where a new fan is installed.

Specifications of the main power cable, which was furnished by the General Cable Corporation, are as follows: three-conductor size No. 1, stranded, $\frac{6}{64}$-in. varnished cambric by $\frac{3}{64}$-in. varnished cambric, $\frac{6}{64}$-in. lead, jute, interlocking plain armor, jute, outside diameter between 1.905 in. and 1.955 in. No. 23PU joint boxes of the same company were used to join the 1,300-ft. lengths in which the cable was installed.

The 3,100-ft. fan branch cable, made by the General Electric Co., has the following specifications: three-conductor, size No. 8, $\frac{6}{64}$-in. varnished cambric by $\frac{3}{64}$-in. varnished cambric, with $\frac{5}{64}$-in. lead, jute, interlocking plain steel armor and jute. No. 193,169 cast-iron couplings and junction boxes were used for making the two splices in this cable.

Over 13,000 ft. of telephone cable is used. This cable is two-conductor, size No. 14, solid, $\frac{3}{64}$-in. code rubber, plain twisted with fillers, tape, $\frac{3}{64}$-in. lead, jute, plain interlocking steel armor, and jute. Part was supplied by the General Cable Corporation and part by the General Electric Co.

An Oldroyd cutting and shearing machine was used to cut a trench 12 to 15 in. from the rail and 18 in. deep by 6 in. wide for burying the cable—both telephone and power cables were put in the same trench. For a greater part of the distance the trench was filled with dirt and other material from the mine floor, but for a distance of 600 ft. in from the portal and also around curves the trench was filled with concrete, this principally because of soft bottom.

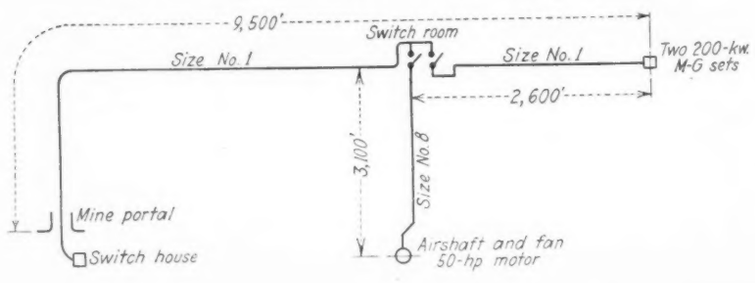
Cable joints are housed in boxes 48

Cover Removed to Show No. 23PU Joint Box.

in. long, 12 in. high and 12 in. deep made from $\frac{1}{4}$-in. steel plate. These boxes are bricked into the rib with the center 30 in. above the floor and with the bolted steel cover flush with the coal surface. At each junction box, the lead sheathing and steel armor of the power cable are grounded to a No. 4/0 copper return line which parallels the haulage track and which is connected to it at every eighth rail. This sheath and armor of the telephone cable are grounded in the same manner every 2,000 ft. This No. 4/0 return wire was not installed as a part of the cable project but represents a standard practice on all main-line tracks.

Disconnect switches in the main cable and in the fan feed cable are installed in a bricked front, gunited room of 5½ x 6-ft. floor dimensions, located at the cable junction point. The main cable

Plan Showing Armored Power Cables Through Mine.

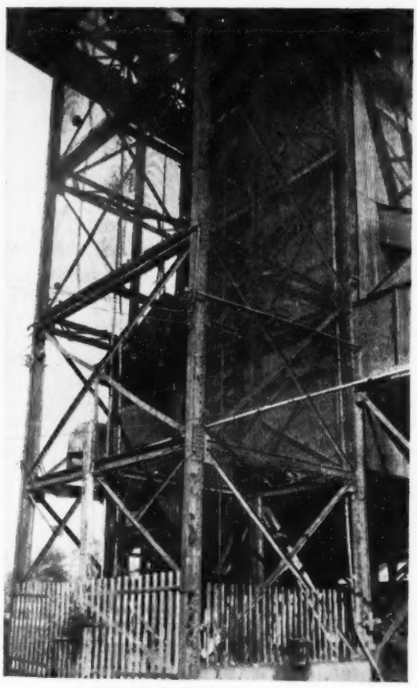


starts from a switch house located outside near the mine portal. In this switch house there is one oil switch for the main incoming power line that serves the mine and another oil switch for the cable. The power company meters are located in the same building.

The main cable is of sufficient capacity to handle an additional 200 kw. of load.

Screening Headframe Promotes Safer Operation

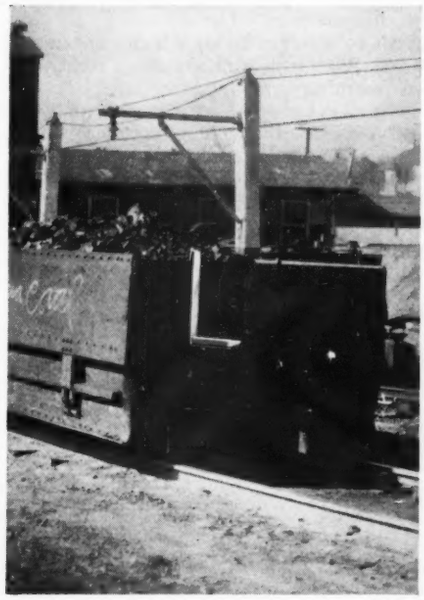
To reduce the possibility of surface employees being injured by falling coal, the headframe at the Lafferty No. 6 mine of the Hanna Coal Co. is screened as shown in the accompanying illustration. Self-dumping cages are employed, and safety gates and fences are installed to prevent men from walking into the shaft.



Reduces the Possibility of Injury From Falling Coal

Detachable Seat Makes Brakemen Safer

Main-line brakemen at the Fairpoint No. 9 mine of the Hanna Coal Co. are provided with a detachable seat for use when riding loaded trips out of the mine. This seat, made of strap iron onto which is bolted a narrow strip of wood as the actual seat part, is hooked over the end of the car when the trip starts out and gives the brakeman a much more secure perch than riding on the bumper—an especially difficult task with the type of cars used at Fairpoint. In addition to the reduction in hazard, the brakeman's comfort is materially increased. When no longer needed, the seat can be lifted off and carried away in the hand.

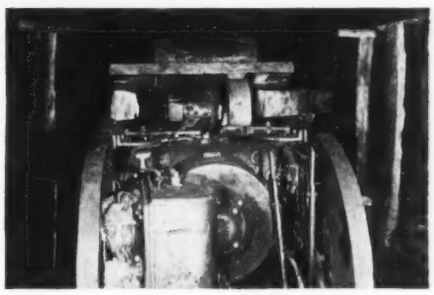


Seat in Place on the Rear Car of a Trip

Blowers Have Eliminated Failures Due to Heat

Totally inclosed motors on the cutting and shearing machines being used in mines of the Hanna Coal Co., in eastern Ohio, did not have sufficient capacity to handle the work without injurious heating. Some armatures lasted less than 30 days and the delays caused thereby were entirely out of keeping with the mechanical and concentrated mining methods employed. Cutting holes in the motor case and applying a blower to supply forced ventilation has eliminated the difficulty.

In the illustration, the machine cover is blocked in a raised position to show the blower and the small motor which drives it. The machine height was increased approximately 10 in. by mounting the blower in this position. The temperature rise on the motor is now but 22 deg. C. This, added to the ambient temperaure of 17½ deg. C., means that the motor temperature runs but 71 deg. C. (103 deg. F.). All of the machines were equipped with the blowers a year ago and since that time no armature failures have occurred.



Cover Raised to Show Blower.

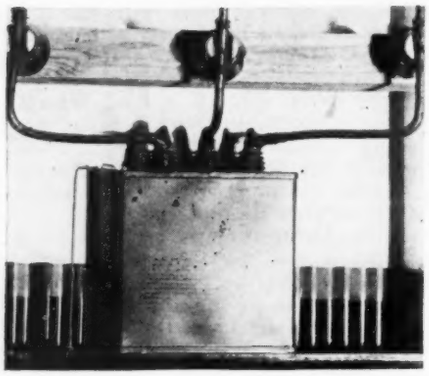
Every Month

This month, we give in this department a selected group of Operating Ideas originated by operating, electrical, mechanical and safety men at the mines of the Hanna Coal Co., which are the subject of this Fourteenth Annual Model Mining Number of *Coal Age*. Next month, however, and every month thereafter, these pages, as usual, will be thrown open to contributions from all sections of the country dealing with methods of reducing cost, increasing efficiency or promoting safety. The items in this issue deserve your close attention; after you have gone over them, send in yours. They will have prompt and sympathetic attention, and if acceptable will be paid for at the rate of $5 or more each. A sketch or photograph should be included if it will help to make the items clearer.

Capacitor Affords Lightning Protection to Substation

Synchronous motors of substation motor-generator sets are damaged frequently by lightning because as a rule the motor is wound for a voltage of 2,300 or higher so as to operate directly from the voltage at which the power is distributed by pole line from the metering point. Rotary converters are almost free from lightning risk because of the protection afforded to them by the transformers, which themselves are not so susceptible to lightning damage. In August, 1933, an improved method of lightning protection which seems to have eliminated past difficulties was installed at a motor-generator substation of the Hanna Coal Co., at the Piney Fork No. 1 mine, located in Jefferson County, Ohio.

The voltage of transmission and of the motors is 4,000 volts, Y-grounded neutral, 2,300 volts to ground. In spite of the fact that modern arresters were installed, damage was done to that particular substation by about 25 per cent of the severe thunderstorms that broke over the neighborhood. In line with a recommendation of engineers of the General Electric Co., a three-phase capacitor unit was installed at the substation and connected to the 4,000-volt line at a point between the lightning ar-



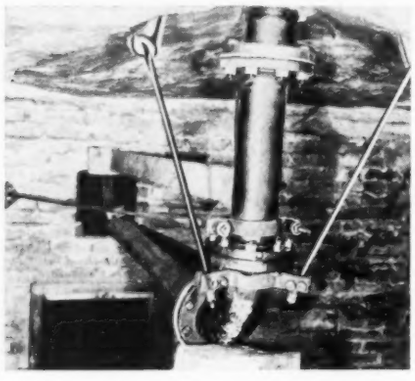
Installed on the Wall in the Substation.

resters and the motors. In this unit are condensers that are connected between each line and ground.

The capacitor was installed in August, 1933, and for the rest of that season and through the lightning season of this year no damage has occurred to the substation.

Fiber Pipe Protects Against Acid at New Borehole

At No. 6 mine of the Hanna Coal Co., Lafferty, Belmont County, Ohio, acid mine water ate away the steel casing of a 230-ft. pump-discharge borehole and allowed the hole to cave to the extent that the hole was ruined. When a new borehole was installed, precautions were taken to make it as lasting as possible. The connection to the bottom of the new borehole is shown in the illustration. The location is adjacent to a pump room which contains a 40-hp. 300-g.p.m. full-automatic centrifugal pumping unit.



Connection at Bottom of Borehole.

The borehole was cased with an 8-in. steel pipe to the solid limestone which was hit at 30 ft. and grout was poured around the 4-in. Bermico pipe installed in the casing. In the illustration a few inches of the Bermico pipe appears next to the roof. It is joined to a flanged sleeve or nipple of acid-resisting bronze. The remainder of the pipe from the flange to the pump-discharge connection is Ace rubber-lined steel pipe.

Three anchors to the roof, a support under the elbow, and a brace and anchor rods to the brick wall assure that neither water-column weight nor mechanical vibration will affect the borehole connection.

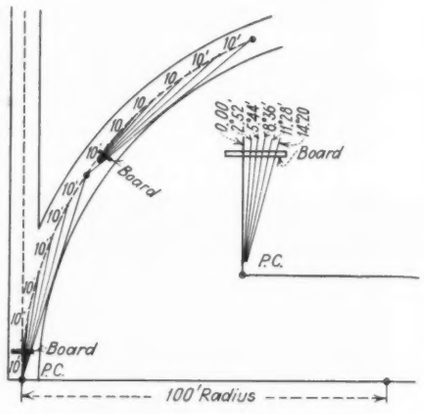
Sights for Turning Curves

Instead of following the general practice and setting only a single sight line in turning curves and directing that the rib be made to lie at certain distances from this line at certain points thereon, the Hanna Coal Co. surveyors place the instruments over the point of curve, *P.C.*, and set a board against the roof a few feet ahead of the instrument. On this board they lay off a series of sights, one for each chord length, turning the instrument through the required angles of deflection, as noted in the accompanying table, just as railroad engineers do in laying off a curve, but the chords used are 10 ft. long, not 50 or 100 ft., as in railroad work.

The heading men, with the assistance of the boss in charge, measure the 10-ft. chords and set marks where the line running from the *P.C.* sight to the required sight on the board intersects the several 10-ft. chord lengths. Thus the center line of the curve is obtained as in railroad work and not merely a point on the rib at the required offset distance from a sight line. This gives a more accurate location for the curve and also gives the heading men a clear idea of the direction in which the heading is being driven.

As these sight lines inevitably intersect the rib before the curve has been extended beyond a certain distance, only six or seven sights can be set on the board, and a new point on the center line has to be set by the surveyors after all these sights have been exhausted. This point on the center line is established by setting the instrument at the right deflection and laying off the length of chord joining the *P.C.* with the new point that is to be established. From this point the curve is extended by the erection of another board, and further sights are set for the extension of the curved heading. Where the curve is long, further points must be established and other boards and sights set.

In surveying on the surface it is the practice of the Hanna company surveyors to take additive angles on the vernier plate, without plunging the telescope, a practice which is in accordance with the method adopted by surveyors when using a theodolite instead of a transit. Each angle is taken four times, and the resulting angle is divided by four. Control lines, termed "fly lines" by the engineering corps, are turned twelve times, the sum on the vernier plate being divided by 12. A 300-ft. steel tape is used for taking distances, and measurements are made on the slope instead of with a level tape and plummets, and these measurements are corrected for horizontality, according to the slope of the measurement as read on the vertical arc of the instrument.



Curves Are Laid Out at Hanna Mines as on Railroads by Means of Sight Lines.

Corners and fly-line stations are carefully connected to suitable points on stationary objects, such as roots of trees and stumps, so that they can be reestablished without difficulty if lost. Such bearings with reference to the witnessing points mentioned, naming the species of tree or stump, are sketched on the mine map so that the surveyor who has one can be directed to such control points or can reestablish them from the notes on the map.

Tables for Laying Out Curves at Hanna Mines

Equal Chords, 90° Central Angle

Radius, Ft.	No. of Chords	Length, Ft.	Deflection From Tangent	Chord Deflection
50	3	25.88	15°00′	30°00′
60	3	31.06	15°00′	30°00′
75	3	38.82	15°00′	30°00′
80	3	41.41	15°00′	30°00′
90	3	46.59	15°00′	30°00′
90	4	35.12	11°15′	22°30′
100	4	39.02	11°15′	22°30′
120	4	46.82	11°15′	22°30′
130	4	50.72	11°15′	22°30′
140	4	54.63	11°15′	22°30′
150	4	58.52	11°15′	22°30′
160	4	62.43	11°15′	22°30′
175	4	68.28	11°15′	22°30′
200	4	78.04	11°15′	22°30′

Deflections for 10-Ft. Chords of Various Radii

Radius, Ft.	10 Ft.	20 Ft.	30 Ft.	40 Ft.	50 Ft.	60 Ft.	70 Ft.
50	5°44′	11°28′	17°13′	22°57′	28°41′	34°26′	40°10′
60	4°46′	9°33′	14°20′	19°07′	23°54′	28°40′	33°27′
75	3°49′	7°38′	11°28′	15°17′	19°07′	22°56′	26°45′
80	3°35′	7°10′	10°43′	14°20′	17°55′	21°30′	25°05′
90	3°11′	6°22′	9°33′	12°44′	15°55′	19°06′	22°17′
100	2°52′	5°44′	8°36′	11°28′	14°20′	17°12′	20°04′
120	2°23′	4°47′	7°10′	9°33′	11°56′	14°20′	16°43′
130	2°12′	4°25′	6°37′	8°49′	11°01′	13°13′	15°26′
140	2°03′	4°06′	6°08′	8°11′	10°14′	12°17′	14°20′
150	1°55′	3°50′	5°45′	7°40′	9°35′	11°30′	13°25′
160	1°47′	3°35′	5°22′	7°10′	8°57′	10°45′	12°32′
175	1°38′	3°16′	4°54′	6°32′	8°10′	9°48′	11°26′
200	1°26′	2°52′	4°18′	5°44′	7°10′	8°36′	10°02′

WORD from the FIELD

Lehigh Briquetting Co. Adding To Producing Facilities

To increase capacity, the Lehigh Briquetting Co., Fargo, N. D., has embarked on a construction program involving the expenditure of not over $335,000 at its Dickinson plant, consisting of a mine, carbonizing unit with a capacity of 200 tons of wet lignite per 24 hours, briquetting plant, distillation plant for tar oils, power plant and coal handling, crushing and screening facilities. The contemplated program embraces the addition of another carbonizing unit to double capacity and the installation of additional briquetting facilities, a new still for the distillation plant, a 750-kw. turbo-generator for the power plant, more mining equipment and some other byproduct machinery.

Indiana Meeting Set

Safety and operating problems will be the topics at the third annual meeting of the Indiana Coal Mining Institute, to be held at the Deming Hotel, Terre Haute, Ind., Dec. 15. Three formal papers will be presented, as follows: "Heat-Treated Machine Bits," by James Hyslop, assistant superintendent, Walter Bledsoe & Co., Terre Haute, with discussion to be led by S. E. Skinner, superintendent, Standard Coal Co., Wheatland, Ind.; "Safety and Economy Attained by the Use of the Hitch Drill," F. M. Schull, superintendent, Binkley Mining Co., Clinton, Ind.; Wright Gaston, mine manager, Walter Bledsoe & Co., leading the discussion; and "Use of the Electric Cap Lamp, Hard-Boiled Hats, Hard-Toed Shoes and Goggles for the Sake of Safety and Efficiency," Henry Thies, Portable Lamp & Equipment Co., Dugger, Ind., with discussion led by Peb G. Conrad, superintendent, Knox Consolidated Coal Corporation, Bicknell, Ind., and N. L. Muir, associate mining engineer, U. S. Bureau of Mines, Vincennes, Ind.

Alabama Meets on Safety

Revival and promotion of safety work in Alabama was the subject of a meeting of nearly 300 operating officials, union representatives, miners and State and federal department men held at Birmingham Nov. 3. Ways and means of securing immediate resumption of the safety program were delegated to the officers and executive committee of the Alabama Council of the Joseph A. Holmes Safety Association, elected as follows: Officers—President, Harry Johnstone, superintendent Republic Steel Corporation; vice-presidents, H. McDermott, vice-president, Newcastle Coal Co.; William Mitch, president, District 20, United Mine Workers, and F. E. Cash, district engineer, U. S. Bureau of Mines; secretary-treasurer, Hubert E. Mills, Alabama Mining Institute. Executive committee—H. McDermott, Erskine Ramsay, A. R. Long, James L. Davidson, Hugh Morrow, H. A. Berg, Milton H. Fies, Wade H. Oldham, A. B. Aldridge, C. E. Abbott, George F. Peter, B. F. Roden, W. E. Leake and W. Frank Cobb, operators; W. B. Hillhouse, chief mine inspector; W. H. Raney, W. H. Huey, J. W. Heathcock, J. O. Parsons, Foster Pierce, J. Harrison Chapman, Otis Young, Forest Capley, Collis Crane, Audrey Hill, Charles White and Rufus Williams, miners.

Since the meeting, district councils have been organized for the Cahaba and Walker County fields and a Jefferson County council will be formed in the near future. Plans also are under way for reviving the 40-odd chapters allowed to lapse during the depression and establish additional ones.

Briquetting Plant Under Way

Installation of a briquetting plant with a capacity of 4 tons per hour was started at the Grand No. 3 mine of the Paris Purity Coal Co., Paris, Ark., last month. The equipment, including a Glenn Smith Co. press, will produce 3x3x3-in. cubes from ¾-in. slack.

September Stoker Sales Break All Records

A total of 4,043 coal-burning stokers were sold in September, 1934, according to statistics furnished the U. S. Bureau of Census by 83 equipment manufacturers. This total is the highest attained since collection of statistics was begun by the government, and includes 3,261 domestic units. The second highest total ever recorded—2,980 units—was in September, 1933. August, 1934, sales aggregated 2,524 units of all types.

DETAILED STATISTICS—STOKER SALES

	Class				
	1	2	3	4	Total
September, 1934...	3,261	346	256	280	4,043
August, 1934.....	1,976	206	110	232	2,524
September, 1933...	2,415	199	163	203	2,980
September, 1932...	1,248	200	100	166	1,714
First nine months, 1934.....	9,668	1,099	572	1,404	12,743
1933.....	6,686	522	599	1,170	8,977
1932.....	4,254	605	369	981	6,209

Class 1—Residential (under 100 lb. of coal per hour). Class 2—Apartment houses and small commercial heating jobs (100 to 200 lb. per hour). Class 3—General commercial heating and small high-pressure steam plants (200 to 300 lb. per hour). Class 4—Large commercial and high-pressure steam plants (over 300 lb. per hour).

Sales Agency for Colorado

Northern Colorado Coals, Inc., has been organized by fourteen northern Colorado producers in Code District L, accounting for an aggregate annual output of over 2,000,000 tons, or more than 90 per cent of the field. The organization plan is similar to that of Appalachian Coals, Inc., with modifications necessary to meet conditions in the major market area (Denver and northern and eastern Colorado). Participating companies include: Black Diamond, National and Rocky Mountain fuel companies; Boulder Valley, Clayton, Imperial, Louisville-Lafayette, William E. Russell and Shamrock coal companies; David Allan; Consolidated Coal & Coke Co.; Leyden Lignite Co.; Liley Coal & Land Co.; and the McNeill Coal Corporation.

H. B. Crandell, Clayton Coal Co., is president of Northern Colorado Coals, Inc.; C. W. Brown, Rocky Mountain Fuel Co., is vice-president; and N. C. Brooks, executive secretary, Northern Colorado Coal Producers' Association, is secretary. Directors are as follows: David Allan; James Brennan, Imperial Coal Co.; W. S. Iliff, National Fuel Co.; H. F. Nash, Leyden Lignite Co.; P. M. Peltier, Boulder Valley Coal Co.; William E. Russell, William E. Russell Coal Co.; F. Yakes, Jr., Louisville-Lafayette Coal Co.; and Messrs. Brown and Crandell.

N.C.A. Committeemen Named

Members of the special legislative committee of the National Coal Association, which has held sixteen meetings since last June, were reappointed by J. P. Williams, Jr., president of the association, last month. These members are: J. D. A. Morrow, president, Pittsburgh Coal Co. (chairman); O. L. Alexander, president, Pocahontas Fuel Co., Inc.; J. D. Francis, president, Island Creek Coal Co.; W. J. Jenkins, president, Consolidated Coal Co. of St. Louis; Charles O'Neill, vice-president, Peale, Peacock & Kerr, Inc.; W. L. Robison, president, Youghiogheny & Ohio Coal Co.; and Grant Stauffer, president, Sinclair Coal Co.

Members of the executive committee of the association named last month by Mr. Williams are: C. E. Bockus, president, Clinchfield Coal Corporation; H. S. Clark, president, Rochester & Pittsburgh Coal Co.; Harry L. Gandy, president, Sheridan-Wyoming Coal Co.; E. C. Mahan, president, Southern Coal & Coke Co.; Fred S. McConnell, vice-president, Enos Coal Mining Co.; and Messrs. Alexander, Francis, Jenkins, Morrow and Robison. Mr. Williams is chairman of the committee by virtue of his office as president.

Mr. O'Neill also was reappointed chairman of the government relations commit-

tee of the association. Other members are: C. C. Dickinson, president, Dickinson Fuel Co.; Milton H. Fies, vice-president, DeBardeleben Coal Corporation; George B. Harrington, president, Chicago, Wilmington & Franklin Coal Co.; Douglas Millard, vice-president, Colorado Fuel & Iron Co.; R. H. Sherwood, president, Central Indiana Coal Co.; George K. Smith, president, Sunday Creek Coal Co.; H. J. Weeks, general manager, Durham Land Co.; J. L. Steinbugler, president, William C. Atwater & Co.; and Mr. Morrow.

A.M.C. Meeting Date Set

Problems of the mining industry will be the major theme of the annual meeting of the American Mining Congress, to be held at the Hotel Mayflower, Washington, D. C., Dec. 13-15. In line with this objective, Howard I. Young, president of the American Zinc, Lead & Smelting Co. and the American Mining Congress, will report on the state of the industry at the opening session, and will be followed by J. F. Callbreath, secretary, with a report of the congress' work in the past year.

Development of a platform for the mining industry will be the chief business at the second session, in the course of which J. P. Williams, Jr., president, National Coal Association and the Koppers Coal Co., will set forth the views of bituminous coal, and C. F. Huber, chairman of the board, Glen Alden Coal Co., will present anthracite's ideas.

Reports of committee and division chairmen, including Eugene McAuliffe, president, Union Pacific Coal Co., and chairman, Bureau of Mines Committee; E. J. Newbaker, vice-president, Berwind-White Coal Mining Co., and chairman, coal division; George R. Delamater, president, W. S. Tyler Co., and chairman, manufacturers' section, and Col. W. R. Roberts. president, Roberts & Schaefer Co., and chairman, coal mining practice committee, will feature the third session on Dec. 14.

The need for cooperative action will be discussed at the fourth session by representatives of the natural-resource industries, including Mr. Williams, after which the platform for the mining industry will be reviewed and adopted.

Meetings of the board of governors of the manufacturers' section and special committees on legislation, the U. S. Bureau of Mines, taxation and standards will feature the final session, on Dec. 15.

Hocking Coals, Inc., Elects

A. F. Arbury, vice-president and formerly with the J. T. Sinclair Coal Co., Detroit, Mich., was elevated to the presidency of Hocking Coals, Inc., at a meeting last month. Mr. Arbury succeeds E. H. Davis, president, Rock Lick Smokeless Coal Co., who remains a director and vice-president. George M. Jones, Jr., vice-president, Ohio Collieries Co., and George K. Smith, president, Sunday Creek Coal Co., were reelected vice-presidents; and R. L. Speice, accountant and statistical expert, was chosen secretary, vice G. K. Mitchell, president, Manhattan Coal Co. Fred Essex, vice-president, Essex Coal Co., was reelected to the treasurer's post.

Economic and Engineering Problems Starred At West Virginia Institute Meeting

ECONOMIC and engineering problems shared the center of the stage at the 27th annual meeting of the West Virginia Coal Mining Institute, Fairmont, W. Va., Nov. 16-17. Discussions of the economic side of the industry revolved largely around code operation and the compilation and use of statistical data, with the benefits from the code highly praised and the "statistical diagnosis" offered as the easiest way for operators to get a clear picture of their problems. Vigorous defense against the attack by medical societies on the contract hospital system was made. Description of an unusual method of timbering was contributed to the discussion of safety work; possibilities for power economies were explored; the increasing interest in conveyor mining in West Virginia was reflected in a paper on hand loading on conveyors at Koppers operations in the smokeless districts.

A warning against being lulled into a false feeling of security by the present

R. J. Burmeister
President-Elect,
West Virginia Coal Mining Institute

favorable position of the industry under the NRA code set-up was sounded by B. R. Gebhart, assistant to the president, Appalachian Coals, Inc., who was the principal speaker at the annual banquet of the institute. Survival in the competition with other fuels, he emphasized, depends upon coal being made available "at the lowest possible cost and in such form that it can be utilized not only at a high degree of efficiency but with convenience and satisfaction."

"Operation under the code, and its administration under the code authorities," said W. G. Crichton, chairman executive committee, Smokeless Code Authority, "has been a success far in excess of the anticipated hope of its most loyal supporters and it is the feeling of the great majority of those representing the industry that the 'great experiment' should be continued for at least two years from April 1, 1934; not that it is a perfect instrument, but when was there ever one of that kind?"

Producers subject to the smokeless subdivision are asked to file only two operating reports with its statistical bureau organized in October, 1933, and located in Washington, D. C. One is a daily production report indicating "no bills" on hand at the beginning and end of the day, number of hours the mine worked, tons produced during the day, tons produced during the month to date, and a report of number of cars by car capacity of each grade of coal that was loaded during the day. The other is the NRA Form X monthly report showing production broken down into local sales, tons shipped by railroad, and so on.

The sales departments are required to furnish the original data necessary for compliance with the marketing provisions of the code. These data, from some 60,000 invoice copies per month, are verified and then assembled by mechanical tabulating machines into comprehensive statistics concerning sales realization for each grade of coal and complete market distribution information for both States and cities. As a check that the coal was properly billed with respect to grade and that all coal shipped was reported to the code authority, use is made of a mine ledger which is a production record maintained daily for each of the mines from the production reports.

Compliance with the code has been better than 99.44 per cent, declared Mr. Crichton. The few actual violations, he continued, were due largely to misinterpretation. "Investigation shows that many of the so-called 'violations' are in reality the propaganda of individuals or corporations who are hoping thereby to gain an unfair advantage in their sales or purchases."

S. D. Brady, Jr., vice-chairman of the Northern West Virginia Sub-Divisional Code Authority, attributed the success in the smokeless field to education before the code. In other districts where the operators all were fighting each other, compliance has been difficult to obtain, but "confidence is gradually coming." One of the greatest initial handicaps was the fact that most districts did not give committees authority to act so that questions could be settled in a short time instead of in weeks; now, however, only the northern West Virginia, western Pennsylvania and Ohio districts have failed to delegate such authority.

Before the industry can work effectively with the government on an expanded statistical program, declared W. E. E. Koepler, secretary, Pocahontas Operators' Association, fear that the consequences will be disadvantageous to the producer must be overcome.

Mr. Koepler felt that reports filed with the government should be checked back to the sources. "There have been instances," he stated, "where some companies have been reported to have consistently padded their reports about 10 per cent—just to be on the safe side. Repugnant as policing is with the Amer-

ican people, it may be necessary until the advantages of exact reporting are understood. The safest way to handle the governmental statistical studies is by assembling them at local district points regardless of whether they are to be handled by experienced coal men in Washington before going to the government or not. Men living in Washington lose their perspective and practical points of view in a few months."

Unfair use of the data compiled, he pointed out, sometimes wrecks a statistical program. For several years the Pocahontas association gathered costs reports from its members and sent out copies of the tabulations to all contributors with the identity of each mine or company concealed by a key number. While some operators "spent days running around the field trying to trade their key numbers with each," the keener-minded used the data as a check on results for their own companies. "When a new tipple was being considered, we would be asked for a special statement of the plants including certain types of tipples. Yardage and deadwork problems could be figured out by sectional cost set-ups, too. Double-shifting problems could be thus studied. Insurance, taxation, compensation and accidents could be traced and improved by studies of field cost tabulations." The program, however, was wrecked when a competitor showed one of the reports to a large coal buyer.

"Next to cost accounting, the most important information is the payroll analysis. We have devised a form of our own which we hope to see in general use, or modified for such utility, as soon as the emergency NRA Form 'C' is discarded. It covers the situation much more thoroughly and again attempts to get information from the viewpoint of the company rather than transposing us into positions to view this problem as union labor men. We have no right to such points of view, and the labor viewpoint would be improved if the company's position were better presented in even the payroll studies. The last column alone, in which we ask for 'Explanations' for earnings below basic rate, produces a wide variety of information that is very valuable.

"This payroll analysis form is not a complicated thing, and now that the mine office forces are accustomed to Form 'C,' it will not be hard to install a real form which will be fruitful to the company itself. The major groupings seek to find out information about the 'Hours Worked,' 'Gross Earnings,' 'Average Earnings,' 'Deductions,' 'Absenteeism' and 'Explanations.' Very few instructions are necessary for this job, and, once accustomed to it, the company would be provided with the protection it does not now get because too few superintendents will examine the payrolls and find out if all is well in this gorgeous source of leakage of company funds."

"The coal industry, the contract hospitals and thousands of employees have a common interest in the preservation of the contract hospital practice," asserted J. A. Luse, Algoma Coal & Coke Co. The subject has become pertinent because of a campaign against the list hospital practice carried on through the medium of the *West Virginia Medical Journal*. "A primary objective of the medical profession has been to increase the medical benefits paid to the profession by industrial subscribers to the workmen's compensation fund. Already it has been successful in making the compensation awards for medical benefits extremely liberal."

R. J. Burmeister, general manager, Raleigh Coal & Coke Co., Raleigh, was elected president of the West Virginia Coal Mining Institute at the annual meeting of the association, at Fairmont, last month. Mr. Burmeister succeeds R. E. Salvati, vice-president, Pond Creek Pocahontas Co., Bartley. Prof. C. E. Lawall, head of the School of Mines, West Virginia University, Morgantown, who was characterized by Mr. Salvati as "the very mainspring of the institute," was re-elected secretary-treasurer.

S. D. Brady, Jr., president, Osage Coal Co., Fairmont; E. E. Agee, superintendent, Younstown Mines Corporation, Dehue; N. P. Rhinehart, chief, West Virginia State Department of Mines, Charleston; Carol Robinson, general manager, Kellys Creek Colliery Co., Charleston; and F. F. Jorgenson, division manager, Consolidation Coal Co., Fairmont, were elected vice-presidents. R. E. Salvati; William J. German, general superintendent, Pocahontas Coal & Coke Co., Pocahontas, Va.; E. H. Shriver, superintendent, Raleigh Coal & Coke Co., Raleigh; Truman Johnson, vice-president, Hutchinson Coal Co., Fairmont; and H. M. Moses, general superintendent, United States Coal & Coke Co., Gary, were elected members of the executive committee.

In the first ten years of the compensation fund the coal industry paid $443,000 in medical benefits and in the second ten years $2,564,000, an increase of 478 per cent. "In 1933, disability payments were $313,000 and the industrial benefits paid were $339,000. In the depression year of 1933, the medical profession for the first time in the history of the fund received more than injured workmen received for temporary disabilities."

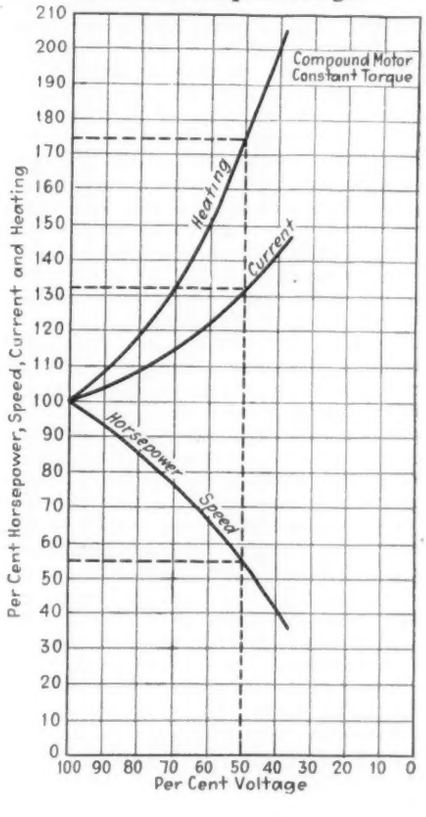
Discussing Mr. Luse's paper, Fred A. Krafft, in charge of industrial relations, Consolidation Coal Co., Fairmont, stated that his company's experience with list hospitals has been very satisfactory. Citing government figures that "62 per cent of the population of the country received no medical, dental or eye treatment," he said that it was evident that list hospitals must come to the front. His company prefers to view the situation purely from the standpoint that it costs less to keep men well than to treat them when sick. In 1927, the Consolidation company began a program of placing all of the plant doctors on a straight salary full-time basis, and the compensation experience improved almost immediately. In 1928, physical examinations were begun, and at one of the large Kentucky operations of the company 960 applicants (16 per cent) out of 5,671 were rejected.

Approximately 30 salaried full-time doctors and 16 to 18 nurses are employed by the company. The latter conduct a public health service to keep the miners' families well. This better health program includes keeping houses repaired to healthful condition, proper sanitation, teaching housewives to can foods and to buy meats to the best advantage, immunization of all employees and members of their families against typhoid, smallpox and diphtheria. This immunization is 100 per cent except in the Maryland division. It was free, but, figured at 25c. per shot, it would have cost the employees $20,000.

At the Jenkins (Ky.) division the employees recently proposed to the company that it offer a complete hospital service to the men and their families at $2.75 per month per employee. This, of course, would not include treatment of obstetrical, communicable, incurable and mental cases. Up to this time the company had offered to employees limited hospital services at 40c. per month for single men, 50c. for married men, and complete hospital service for $1 per month for single men and $1.50 for married men. There are about 3,400 employees in the division, and it is likely that the company will answer the demand for this health insurance. "There is much in favor of list hospital service," was the conclusion of Mr. Krafft.

Reduction of maintenance cost from 13.8c. per ton to 4.6c. per ton, the actual accomplishment at a certain mine, was cited by W. A. Buchanan, district manager, Appalachian Power Co., Welch, to indicate the possibilities by improvement of direct-current voltage. At that operation, the program inaugurated consisted of: (1) installation of an additional 300-kw. converter substation; (2) installation of five miles of feeder cable of sizes

Showing How Speed Is Decreased and Current and Heating Are Increased by a 50 Per Cent Drop in Voltage.



500,000 to 1,000,000 circ.mil.; (3) increasing the size of rail bonds from 2/0 to 4/0 with double bonding; (4) awarding all armature repair work on a contract basis, and (5) reconditioning all locomotives, cutting machines and pumps. The actual saving was $116,000.

Based on experience of the power company's service to around 600 mining customers in West Virginia, Kentucky and Virginia, Mr. Buchanan said he is convinced that the d.c. distribution system from substation to the working face is "the most neglected part of the power supply serving coal-mining operations. This condition exists, I believe, because the cost of power is such a relatively small part of his total production cost that the average mine operator does not realize how seriously poor voltage at the working face affects the operations of his mine." Excessive conductor losses, higher maintenance cost and decreased production are the most important effects of poor voltage upon mine operation. Two of the charts used by Mr. Buchanan are shown herewith.

Leading a discussion of the paper, R. L. Kingsland, electrical engineer, Consolidation Coal Co., said that the cost statement depends in a large measure upon a "uniform flow of coal to the tipple," and if the mine is not supplied with good voltage that uniform flow cannot be attained. "It is unfortunate it is not practical to have the power company deliver the d.c. power to the face," remarked J. H. Edwards, associate editor, *Coal Age*. "What an outcry the coal company would put up if the voltage so delivered was no better than the coal company usually delivers to itself."

"Conveyor Mining at Mines of the Koppers Coal & Transportation Co., C.C.B. Division," was discussed in a paper by M. Albert Evans, division engineer, read by Stanley Higgins, secretary, New River Operators' Association. The work consists of hand-loading onto drag-chain-type conveyors in two mines; Stotesbury No. 8, in from 32 to 42 in. of Pocahontas No. 4 seam, and Glen White, in 26 to 48 in. of Beckley seam. "An appreciable part of the tonnage mined by conveyors in our division," said the paper, "has been in development work. Approximately five miles of entry system has been driven by this method. This has proved economical where development speed is urgent; in cases where it was necessary to shoot top or bottom, which otherwise would not have to be taken, in order to use mine cars; and in isolated conditions where a motor was not available. However, under normal development conditions, with the same consideration given to hand work with mine cars as is accepted as necessary for conveyor work, we have found that a satisfactory advancement can be made with the same labor cost, and the investment in conveyor cannot be justified by the small production available."

The rest of the conveyor work has been room-and-pillar work. In the Glen White mine, 150-ft. modified longwall was first tried, but was discontinued because of the excessive deadwork involved in moving the conveyor forward after each cut, and because the men became uneasy due to the noise of the conveyor preventing their hearing the top in case it started working. The 150-ft. faces were identical with those that have been worked successfully with scraper loading in that mine since 1925.

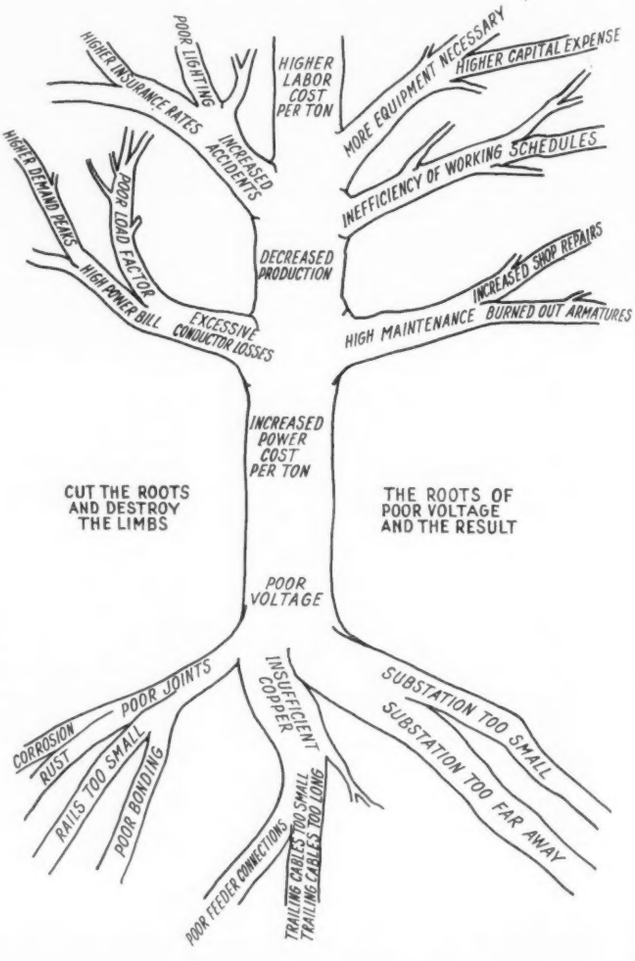
The present system in Glen White mine is to drive butt entries with single panels for 300-ft. rooms. The butt-entry distance between barrier pillars is 1,500 ft., which it is calculated will allow the coal to be removed before it will be necessary to replace entry timbers. In this mine the entire pillar, including the entry stump, is pulled before getting a fall. A narrow chain pillar is left for the top to break against, and as a precautionary measure the face conveyor and tailpiece of the room conveyor are removed over the week-end.

At Stotesbury, 20-ft. rooms on 60-ft. centers were first tried, but, due to the speed of development, the drawslate acted so favorably that the room width was increased to 50 ft. Later, 40-ft. rooms on 80-ft. centers were adopted, and this has not been changed. Twelve-foot face conveyors were first used, but on 40-ft. faces the capacity was not sufficient, so these were replaced for the most part with single-unit, low-type face conveyors that are placed within 2 ft. of the coal before shooting. Experience has shown that four men make the most efficient crew on a 40-ft. face. That the crew leader is an extremely important member of the crew is indicated by drops of approximately 40 per cent in tonnage in several instances where experienced leaders were removed.

More comprehensive and useful methods of tabulating accident records in the West Virginia Department of Mines were discussed by N. P. Rhinehart, chief of the department. Re-injuries are now being recorded and length of service has been added to prove the true relation of labor turnover to accidents. Beginning this year it is expected to obtain accurate information on man-hours' exposure and thus add to the production rate the frequency rates. The paper listed under classified heads the various general reasons for unsafe acts and for physical failures. Knowing the reason for the unsafe act or failure forms the basis for applying corrective measures.

Mr. Higgins said that a safety committee is now considered one of the most important of the committees of the New River operators. The work was started five years ago and is carried on by analyzing all accidents and discussing them at meetings with district inspectors and safety engineers. J. H. Benson, general safety inspector, Koppers mines, stated his company has found accurate records are vital in safety work and that by such records they are able to predict by July 5, within 1c., the compensation cost for the next year. R. E. Salvati said the Pond Creek Pocahontas Co. gives a banquet every three months to shot firemen and foremen and that those who are charged with accidents must sit at a table with a black cover cloth and must later stand up and tell about the accident.

Cornish or inverted-V wood sets in entries, and the use of four 20-lb. steel rail



The Weed That Grows From the Roots of Poor Voltage.

hitched into the face to protect cutting machines are among the several timbering methods that were described by E. S. Wade, mine superintendent, Beech Bottom mine, Windsor Power House Coal Co., located in Brooke County, about 15 miles from Wheeling. Roof accidents, which a few years ago were extremely frequent in the mine, have been practically eliminated.

In that particular district the Pittsburgh No. 8 seam, there 4½ ft. thick, has an especially bad top which in 24-ft. rooms can be held in place only about four months if adequately timbered. Drawslate, laminations, shale and fireclay to a height of about 15 ft. will come down as distintegration takes place. Timbering of main haulways for the most part consists of 60-lb. rails with one end hitched into the rib and the other set on a locust post about 18 in. long recessed into the rib. These steel rails are 4 to 5 ft. apart and lagged over the top with culled posts. When bending of the rails indicates excessive weight of fallen material, a hole is made in the lagging and sufficient material loaded out to allow the steel to spring back to normal.

During the last four or five years the steel crossbars have been replaced wherever practicable with the inverted-V sets made from round locust posts. The ends are recessed in the rib at the top of the coal. The cost is lower than for steel and there is the advantage of extra headroom. Satisfactory results have been obtained with the height at the center as little as 12 in. in the headings, which are 9 to 9½ ft. wide. On butt entries, many of which have to be timbered for nearly their whole length, the inverted-V sets also are used, but are of regular round posts instead of locust, as the former will outlast the butt entry.

In rooms where the drawslate is especially dangerous it is taken down and gobbed, but wherever possible it is held by close posting. Ready for the cutting machine, the face is protected by four 20-lb. rails hitched into the face and with the other ends supported with posts, the front row of which is 6½ ft. from the face. The loaders first set two rows of posts across the face, bringing the posting to within 6 in. of the face and then take down the steel rails. Two holes are then shot separately, each located 21 in. from the center line. As soon as sufficient coal is loaded, a safety post is set in the center and then as loading progresses additional posts are set until five are in place across the face, making a total of nine safety posts set.

Because of a limestone stratum which bends and will not break, no pillars are taken in the mine. The original plan of driving entries 1,400 ft. apart, butt entries 440 ft. apart, and turning 38 rooms 220 ft. long, 24 ft. wide on 32-ft. centers, had to be modified because some panels had to be abandoned before all of the rooms were driven. It was decided that there must be shorter and fewer rooms in each panel. The panel is divided in half by leaving a pillar the width of two rooms and the pillars, and the rooms are driven 220 ft. from one side and stopped. Next rooms are driven 180 ft. from the outbye entry to hole into old workings.

Operating Problems, Research and Safety Hold Floor at Illinois Meeting

UNDERGROUND operation, research, safety and coal cleaning featured the technical sessions at the 42d annual meeting of the Illinois Mining Institute, held at Springfield, Ill., Nov. 2. And Ralph E. Taggart, vice-president, Stonega Coke & Coal Co., Philadelphia, Pa., speaking at the annual banquet, that evening, described the present wage situation in the Appalachian region and urged his hearers to present coal's case against the federal power program to Senators and Representatives before the opening of the next session of Congress.

Members approved a resolution supporting the request of the president of the University of Illinois for appropriations of $826,000 for construction and $43,000 for operation of a building for the mineral research activities of the Illinois Geological Survey. The institute also recorded its approval of greater financial support of the U. S. Bureau of Mines and empowered its executive board to consider a proposal that financial aid be contributed to the Bureau of Mines committee of the American Mining Congress. C. F. Hamilton, vice-president, Binkley Mining Co., and T. J. Thomas, president, Valier Coal Co., presided at the technical sessions.

C. J. Sandoe
President-Elect, Illinois Mining Institute

"While our experiments convince us that the additional labor and maintenance expense offsets the costs of powder shooting . . . we can still net a few cents increased realization at the present market" with air shooting, after deducting "what we consider an adequate charge per ton to pay for the machine," declared G. S. Jenkins, mine engineer, Consolidated Coal Co. of St. Louis, in discussing the use of Air-Dox at the Herrin (Ill.) No. 7 mine of the company.

Herrin No. 7 operates in the No. 6 seam, but the coal, as compared with neighboring operations, seems very friable and tends to "chill" when shot with powder, thus increasing screenings output. Streaks of mother coal are encountered throughout the seam and slips are frequent, often, when concealed, limiting the effectiveness of powder shots. In addition, the top and bottom are rolling, so that the coal at times pinches down from its normal height of 7 ft. to 3 ft.

About 18 in. of top coal is left in each place. This is not the natural parting, but the "6 in." must be left to provide adequate roof protection, as shooting to the natural parting leaves 12 in. of top coal, which comes down in a week or two, exposing the shale roof, which disintegrates in air and falls in pieces weighing up to 5 to 10 tons. These conditions make shooting to an unnatural parting necessary, and consequently increase blasting difficulties.

If holes could be loaded and shot singly, thus allowing proper gaging of powder charges after shooting an adjacent hole, this difficulty might be overcome. But with shooting limited to the off-shift, the necessity for allowing time for the night shift and examination of the mine made such a system impossible. As a result, overshooting was the general rule to avoid tight coal and improper preparation for the mechanical loaders. While this was of no consequence in the summer time, the problem was quite critical in winter with the shift to larger sizes.

For these reasons, the work at the Royalton mine of the Franklin County Coal Co. was followed with much interest, and resulted in a decision to try air shooting. Air-Dox was announced at that time, and a compressor unit was installed in a territory where two Joy loaders were operating. The fact that the strength of the charge could be varied at the will of the operator, thus allowing the shooting effect to be regulated in accordance with the slips encountered, was a major factor influencing the decision.

Originally, a 180-cu.in. shell and No. 272 "Little Giant" drills were employed, but this size of shell was discarded because too many holes were required to break down a cut properly. A 300-cu.in. shell was then adopted, with better results, although many tight corners were encountered. This resulted in a change to a 400-cu.in. shell (60 in. long, 4 in. in diameter, and weighing approximately 70 lb.), which really did the work, although it necessitated a change to the No. 474 drill, which requires two men.

Six or seven holes are required for a 24-ft. place, and two men drill for a Joy unit, making it necessary to have two drill crews for the two loading machines, who put in the holes and throw back the cuttings. The coal in this particular section varies from 7½ to 8 ft. and is undercut 8½ ft. Under the present set-up, involving the use of purchased power, it has been advisable to shoot on the second shift, although a

few holes occasionally are shot on the day shift, when necessary. The traffic problem growing out of the operation of two loaders, two cutters, two drill trucks and three locomotives in a maximum of twenty places was another factor in this decision. When powerplant revisions are completed, however, and unlimited power is available, adequate facilities will be provided to permit shooting on the day shift, whereupon the compressor will service two Joys on both the first and second shifts. The compressor crew comprises two men at shooters' wages, one operating the compressor and the other placing the shells and gaging the charge, which can be estimated very closely after practice.

"Proper drilling is just as responsible for satisfactory preparation of the coal as the proper charge — perhaps just a little more so. We are convinced that the proper method is to drill a hole straight in 6 in. short of the undercut." Gripping holes do not pull properly and throw out the shell. As Air-Dox, because of its slowness, does not pull much above the hole itself, top holes must be at almost the height required for the desired top-coal thickness. Holes on the solid result in the projection of the shell without effective action on the coal.

Standard practice is to pull the shell out after insertion so that it is 6 in. from the back of the hole, thus tending to produce a better coal with less chance of shell projection. Tamping was found impracticable, due to the fact that some air escaped before the retaining valve seated after pumping started, and cracked the tamping. In general, the operating cycle is divided about 50-50 between pumping and inspection and placing of the shell and estimation of the charge.

In response to questions, Mr. Jenkins stated that no appreciable difference was noted when tamping was omitted, and that retamping, involving additional labor, had not been tried; approximately 15 to 20 per cent of the shells are projected not over 6 ft. from the cut; 1½ to 2½ minutes is required to charge a shell; shots pull to the back of the cut; daily screen tests are made; loader tonnage went down at first, due to the large lumps, but is now back up to standard; and that breaks in the tubing usually occur in the "pigtail" on the shell, which is replaced with a spare, the broken one being sent out for repair.

Coal research in Illinois, stated Dr. M. M. Leighton, chief, Illinois Geological Survey, has stressed the following phases: the nature of coal; ingredients in fine coal with reference to separability and production of specially adapted fuels; conversion of slack into a marketable product; coking characteristics of Illinois coal as a basis for satisfactory oven design and operation; classification based on heat value and other properties; and the competitive position of Illinois coal in relation to natural gas and fuel oil.

The nature of coal has been approached from the standpoint of its constituents, including the fundamental four (clarain, vitrain, durain and fusain), and also the constituents of each in relation to their effect on and control of the use of the larger constituents of the entire coal. In all, 28 column samples have been taken from the No. 6 seam in ten representative counties, five from the No. 5, three from the No. 2 and one from the No. 1. Data derived show conclusively an increase in vitrain from the northwest to the southeast, as well as local variations in fusain influencing the use of the coal.

Financial aid has been obtained from the National Research Council for study of the plant components of the coal bed, which holds out hope of a better understanding of the physical nature of coal. Investigation of the mineral composition of coal is well under way to obtain basic information for evaluation of the effect of ash characteristics on combustion, selective mining and cleaning.

Investigation of the disposition of the banded ingredients in the various float-and-sink fractions, including determination of the calorific value of each fraction, shows a concentration of vitrain in the lighter fractions and fusain in the dust; also, that the proportion of vitrain and clarain differs in each fraction and affects its use. Calorific values for the different fractions also vary in a manner not in accordance with the former concept that coal is a single substance diluted by ash. This indicates the significance of precise information and the development of a more refined technique in coal preparation and utilization, using a method that eliminates deterioration, as in the case of liquids.

Study of the physical properties of coal in relation to temperature, pressure and time led last year to the discovery of a method of briquetting fine coal by impact without an artificial binder and this year to the discovery of a method of making smokeless briquets—i.e., briquets giving off one-fifth the smoke of Pocahontas coal. This development would have been impossible except by the impact method without binder, and proves the wisdom of this new approach to briquetting.

In studying coking characteristics, Dr. Leighton reported, it was found that certain coals tended to swell too much, resulting in a light, friable coke. Addition of fusain, however, resulted in a blockier coke of greater strength. Dust from dedusting plants offers a convenient source of fusain.

Basing it on the premise that "a majority of all mine accidents are preventable and in most cases are due to carelessness and dangerous practices that, as a rule, detract from efficient operation of the mine and may well be eliminated," C. A. Herbert, supervising engineer, U. S. Bureau of Mines, Vincennes, Ind., outlined an accident-prevention program based on Bureau cooperation that, "if properly and intelligently carried out in part or entirely, will bring about satisfactory results."

In its essentials, the program includes five phases: (1) a study of accident records and report by the Bureau engineer to find out what is causing accidents and who is getting hurt as the first step in prevention; (2) a safety inspection, including air measurements and samples and a study of the coal-dust hazard, supplemented by sampling; (3) a course for officials to bring home to them their responsibility in the prevention of accidents and the fact that permitting dangerous conditions and practices to exist is not necessary for maximum production and low cost; (4) first-aid training, usually through selecting certain employees for the course, who later act as instructors for the rest. Such training not only enables the miner to act competently in case of injury but gives him the feeling that he has a personal stake in the program. At the same time he is absorbing accident-prevention ideas and speculating on needless accidents and methods of avoiding them; and (5) establishment and maintenance of a safety organization, such as a Holmes safety chapter, to enlist the support and cooperation of the men.

The money cost of such a safety program, said Mr. Herbert, is small, but much time, hard work and hard thinking on the part of officials are necessary, as results vary directly with the effort expended. The men will go along if convinced that the company is sincere and is not trying to pass the buck. All possible assistance consonant with limited personnel will be given by the Bureau, and the operator also is assured the support of State mining departments. Similar programs elsewhere, he stated, have yielded satisfactory results. As an example, the frequency rate at the No. 1 mine of the Knox Consolidated Coal Corporation, Bicknell, Ind., was reduced from 187.3 in 1932 to 43.6 for the fifteen months July 1, 1933-Sept. 30, 1934; severity rate in the same periods, from 41.1 to 1.3. At the No. 2 mine, frequency in the same periods was cut from 137.7 to 30.9; severity, from 26.0 to 1.7. At the same time, efficiency was increased without additional cost.

The system outlined by Mr. Herbert was indorsed by John Lyons, safety engineer, Bell & Zoller Coal & Mining Co., Zeigler, Ill., who declared that a

Officers were elected at the 42d annual meeting of the Illinois Mining Institute as follows:

President—C. J. Sandoe, vice-president, West Virginia Coal Co. of Missouri, St. Louis, Mo.

Vice-President — T. J. Thomas, president, Valier Coal Co., Chicago.

Secretary-Treasurer—B. E. Schonthal, B. E. Schonthal & Co., Chicago (reelected).

Executive Board—W. C. Argust, Peabody Coal Co.; W. J. Austin, Hercules Powder Co.; Paul W. Beda, Old Ben Coal Corporation; C. F. Hamilton, Pyramid Coal Corporation; A. F. Dodd, United States Fuel Co.; W. J. Jenkins, Consolidated Coal Co. of St. Louis; M. M. Leighton, chief, Illinois Geological Survey; James McSherry, chief, Illinois Department of Mines and Minerals; F. S. Pfahler, Superior Coal Co.; H. H. Taylor, Jr., Franklin County Coal Corporation; H. A. Treadwell, Chicago, Wilmington & Franklin Coal Co.; and Paul Weir, Bell & Zoller Coal & Mining Co.

substantially similar program was responsible for a marked decrease in accidents at the mines of his company since 1929. Many of the ways of doing things in a mine are inherited from earlier miners who generally were of the opinion that accidents were predestined, said D. D. Wilcox, general superintendent, Superior Coal Co., Gillespie, Ill., and experience at the Superior operations has shown that revisions in practices from a safety standpoint have increased efficiency. H. A. Treadwell, general superintendent, Chicago, Wilmington & Franklin Coal Co., Benton, Ill., reported that the company had started a campaign based on the Bureau plan early this year, which already has shown a reduction in accidents and an increase in efficiency and output per man.

Fundamental principles affecting the choice of coal-cleaning equipment were discussed by Byron M. Bird, chief concentration engineer, Battelle Memorial Institute, Columbus, Ohio. Confining his remarks to sizes under 6 or 4 in., Mr. Bird explained that it is more satisfactory and economical to hand-pick the larger sizes, in that, in mechanical cleaning, pieces containing center impurities might pass over into the cleaned product.

The first factor in the choice of equipment is the determination of the relative difficulty of the cleaning problem by float-and-sink tests, screen analyses and visual inspection of the float-and-sink products. The latter may be valuable in that while the ash may come within the bounds, the appearance of certain fractions might be objectionable and thus possibly necessitate making a middling product for retreatment. In studying float-and-sink results, it should be remembered that "no coal is inherently easy or difficult to clean," the problem depending upon market requirements. Any coal is easy to clean when operating at a high gravity, but as the gravity is lowered the problem becomes more difficult.

Comparing the fields of wet and dry processes, Mr. Bird referred to his system of classification* employing an index of cleaning difficulty. On this basis, an index of 0-3 per cent covers, in general, the range of dry-cleaning processes; 0-7 per cent, wet-cleaning processes; and 0-15 per cent, wet plunger jigs and wet tables. These limits represent roughly the type of problem now being handled and are not necessarily an indication that any one process will not be able to operate successfully over a wider range. The wide divergence between wet and dry processes is explained by the fact that water is a medium and influences the separation process. Thus, in air, with a heavy particle of 1.50 sp.gr. and a lighter particle with a gravity of 1.35, the ratio which governs relative separability is, for practical purposes, $\frac{1.50}{1.35}$. In water, however, the specific gravity of the water must be subtracted, thus increasing the ratio to $\frac{0.50}{0.35}$. Thus, wet cleaning has an inherent advantage, although this is not an indication that dry cleaning will not give equal results if greater skill is used in operating the dry process than is used in the wet process.

From the cost standpoint and considering actual cleaning alone, wet processes are cheaper than dry. Cost, however, must include auxiliary equipment, and with wet processes a part or all of the added water must be removed, a task that becomes more costly as the size of the coal decreases. For that reason, dry cleaning may be cheaper for sizes below a certain dividing line, which might vary from ¼ to, perhaps, ⅜ in. Also, from a cost standpoint, it may be more economical to choose a less efficient process and go after a lower-priced market.

*"Interpretation of Float and Sink Data," Third International Conference on Bituminous Coal (1931).

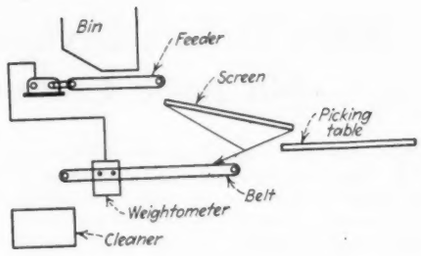


Fig. 1—Varying Feeder Speed to Assure Uniform Rate of Feed to Washer

Undersize drops through the screen onto the belt feeding the cleaner. The belt is equipped with a "Weightometer" with suitable electrical connections to a variable-speed drive on the feeder. As the quantity of material through the screen increases or decreases, it is reflected on the Weightometer and in turn in the speed of the feeder. In this case, sufficient picking-table capacity is provided to take care of the maximum variation in quantity of oversize.

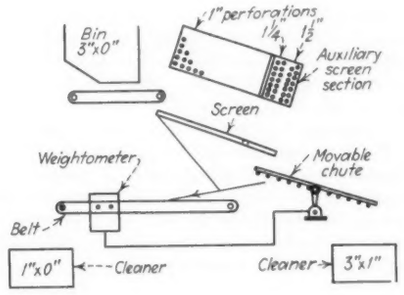


Fig. 2—Varying Size of Feed to Assure Uniform Rate of Feed to Two Washers

In addition to the regular perforations for screening out, for example, 1x0-in. material to go to one washer and 3x1-in. material to go to the other cleaner, the lower end of the screen is equipped with a section having perforations possibly ¼ and ½ in. larger than the standard perforations. Then, when the feed to the 1x0-in. washer decreases, the Weightometer starts up the motor on the movable chute illustrated, moving it to the right sufficiently to allow some 1¼x1-in. material made on the auxiliary section to drop through. In this case the feed to the 1x0-in. cleaner would be 1¼x0 in. instead of 1x0 in. In case of an increase in the 1x0-in. feed, the movable trough would move to the left enough to catch some of the 1x0-in. material. At the end of the screen this would be mainly 1x¾-in. sizes and the feed to the 3x1-in. cleaner would be 3x¾-in. With the proper control system, any split between the two limits would be made automatically. By installing additional belts and Weightometers, the system would serve also three, or more, cleaners.

"Rash," where it occurs, may be a very difficult problem. Experience in Alabama with flaky material of all specific gravities has resulted in the development of a successful jig technique for its removal, and therefore it might be profitable to consider jigs where this material is encountered. Wet tables also handle the material satisfactorily. In the case of clay, no satisfactory solution has yet been evolved, but it is an excellent idea to keep it from getting wet.

In the application of a process, the question of the range of sizes to be treated in one operation comes up. Where the separation problem already is critical, increasing the range of sizes adds still further to the difficulties of separation. Marked improvement is possible, however, when the feed contains the proper proportion of the intermediate sizes. This principle is not well known as yet, but in a number of cases poor cleaning results have been due to the absence of the intermediate sizes.

Cleaner capacity, Mr. Bird pointed out, must be based on the cleaning limits set up for the smallest size treated. Water supply must be ample, and a gravity system should be employed to assure a constant head on washers and thus minimize fluctuations in results that otherwise may be encountered. Equipment also should be arranged so that the operator can see the products, as a skilled man can do much in regulating operation by visual examination.

Auxiliary equipment takes in both that ahead of and after the cleaner. Equipment ahead of the cleaner should (*a*) supply a uniform quantity of coal to the cleaner; (*b*) uniform size gradation; (*c*) a feed with the proper moisture content; and (*d*) uniform quality. Some form of storage is the solution to the problem of uniform quantity. Mine-run storage, if employed, should have sufficient capacity to take care of the maximum possible operating delay. It brings up, however, the questions of segregation of sizes and breakage. To reduce breakage, Mr. Bird suggested the use of bins with bottoms sloping just a little more than the angle of repose of the coal. These are uneconomical from the standpoint of space requirements, but this is not often a controlling factor at mine plants.

Having mine-run storage, the next problem is to avoid any further storage in the plant. Two methods suggested by Mr. Bird—one based on automatic variation of feeder speed and the other varying slightly the size limits of the feed—are shown diagrammatically in Figs 1 and 2. Varying size of feed is designed for use in cleaning two sizes. Storage of slack, rather than mine-run, also is a possibility, particularly where tipple capacity is sufficient to take care of the lump size. Much the same principles apply in storing slack as in storing mine-run.

Uniform gradation of sizes in the cleaner feed is particularly important, as segregation has wrecked many coal-cleaning installations. One answer is to provide some means, such as a traveling conveyor, to spread the coal back and forth across the bin. Vertical division

partitions in the bin also may help by reducing segregation.

Mixing sometimes is necessary to take care of size variations occurring in the mine. One method, used at Nemacolin, Pa., is the use of several feeders drawing coal from different levels along the sloping bin bottom. Also, it may be feasible to collect the mine cars at some central point to allow them to be sent to the washer in an order which will assure mixing.

Proper moisture content in the feed is important in all processes, but particularly so where dry cleaners are used. In the latter case, the feed must be very dry (without surface moisture), as the presence of moisture tends to lock the particles together and thus interfere with separation. Dedusting with heated air may be helpful. Dedusting prior to wet washing is primarily a question of balancing the cost of dedusting a large raw-coal tonnage against the benefits secured through elimination of dewatering the fine coal.

Of the operations subsequent to cleaning, handling wet coal presents the greatest number of problems. In dewatering, observed Mr. Bird, the fines should not be allowed to separate from the coarser materials. The presence of some coarse coal acts as a filter which materially increases efficiency. An effective design of sludge tank is the one in which the drag chain and flights act as an elevator and drag the coal over dewatering screens. The resultant squeezing action greatly increases the rate of water removal. Installation of sloping baffles in the sludge tank offers a material increase in efficiency of settling. These inclined baffles extend up sufficiently high so that there is only a thin layer of water flowing over them. Consequently, the coal particles have only a short distance to drop before striking the sloping baffles, which carries them down onto the drag.

In regard to the refuse-disposal question, Mr. Bird recommended that water overflowing the refuse elevator be run to waste or treated separately. It should not be allowed to return to the wash water, as it eventually will dirty it and therefore raise the ash content of the cleaned coal.

Auxiliary activities may be more important than the actual cleaning process, said J. B. Morrow, preparation manager, Pittsburgh Coal Co. Too much attention is paid to what is done in the cleaner, whereas the trade does not ordinarily judge coal on impurities but rather on screening and loading. Mr. Morrow based this conclusion on an investigation of complaints, which showed that only 8 per cent could be traced back to ash and sulphur, while 55 per cent involved screening, mixing and loading.

Development of new uses for fine sizes may relieve the operator of much of the expense and difficulty in preparing them, as there is a possibility that as much cleaning will not be necessary, said George R. Delamater, W. S. Tyler & Co., Cleveland, Ohio. Uniformity of shipments, particularly to consumers taking large tonnages, has not received the attention it deserves, said Mr. Thomas.

NRA Orders Divisional Statistical Set-up; No Basic Code Changes Forecast

AN AMENDMENT to the bituminous code making the establishment of divisional statistical bureaus mandatory, tightening up on compliance and enforcement, and a flood of "floor-cost" determinations for the retail trade were high spots in NRA code administration last month. Although industry at large is busy speculating on what changes in basic code structures may be inaugurated by NIRB, it is considered unlikely that the new board will recommend or promulgate any fundamental revisions in the bitumionus coal code. Regardless of what decision NIRB finally may reach with respect to future policies on price fixing and production control, coal-code provisions on these subjects, it is believed, will not be disturbed.

Officials familiar with the situation generally are ready to concede that price control is essential to the maintenance of the bituminous code. Coupled with this recognition is the conviction that prices of competitive fuels, hydro-electric power and inter-district rivalries may be counted upon to act as effective checks upon coal-price levels which might be unfair to the consumer. In addition, as was made clear in the report of the special legislative committee of the National Coal Association (*Coal Age*, November, 1934, p. 415), the administration views the efforts of the industry to plan for future regulation with sympathetic eyes.

The deadlock over Form "C" of NRA continued throughout November. This dispute revolves around the question of what constitutes "a start" and, as a result of the disagreement, figures are being collected by three different groups of operators on three different bases. The NRA research and planning division has threatened to bring the conflict to a head by appealing to NIRB for an order compelling compilation on a uniform basis or, as an alternative, an order eliminating all statistical activities of NRA in connection with the code and the wage studies of the North-South Differential Commission. Such an alternative order, however, would not be satisfactory to certain other divisions where officials feel that it is essential to have the monthly reports on costs and realizations to justify the minimum prices approved by NRA.

Mandatory establishment of statistical bureaus is effected by an amendment approved Nov. 5 striking out Sec. 3, Art. VII, of the original code. The new Sec. 3 directs each code authority to set up and maintain a statistical bureau under a managing director who may also be the code authority secretary, but who must be divorced from all active or official connection with any producer. Operators subject to the code authority must file reports of all spot orders, copies of contracts, invoices and credit memoranda "and such other information concerning the production and sale of coal as such code authority, with the approval of its Presidential member, may require."

All records and reports shall be considered confidential, but the bureau, when directed by the code authority, may compile composite data on sales and distribution therefrom "in such manner as shall not be prejudicial to the interests of any producer." When, in the opinion of the managing director, examination of the records discloses a violation of the code, he shall report that fact to the Presidential member "with any information necessary to enable the Presidential member to consider such violation." The latter also shall have access to any records of producers subject to the code authority to the extent necessary to determine the validity of any complaint of unfair practices which may be made. If the Presidential member is of the opinion that the complaint discloses a code violation, he shall report such violation to the code authority "together with any reports or other information filed in accordance with the provisions of this section which may appear necessary to enable the code authority to consider the merits of such violation and to take such steps as it shall deem necessary to secure observance of the code."

As provided in the original code, the substitute section requires producers to furnish any government agencies designated by the administrator "such statistical information as the administrator may from time to time deem necessary for the purpose recited in Sec. 3(a) of NIRA." Failure to file reports or filing materially inaccurate information is made a violation of the code. Administration expenses are to be assessed on a tonnage basis; failure to pay such assessments also is made a violation of the code.

Adoption of the amendment in its present form represents a victory for the operators who fought the proposal to put the statistical bureaus under the direct control of the Presidential members. Establishment of these bureaus was first formally proposed at a meeting of representatives of the code authorities for Divisions I and II last June (*Coal Age*, July, 1934, p. 292). Following this proposal, it was resubmitted to the industry by NRA in a revised form which transferred control to the Presidential members; to this revision, the industry declined to assent (*Coal Age*, September, 1934, p. 364).

Several steps were taken by NIRB last month to tighten up on its over-all enforce-

Permissible Plates Issued

Five approvals of permissible equipment were issued by the U. S. Bureau of Mines in October, as follows:

Sullivan Machinery Co.; Type CR-8 shortwall mining machine; 50-hp. motor, 250 and 500 volts, d.c.; Approvals 270 and 270A; Oct. 11.

LaDel Conveyor & Mfg. Co.; Model SLS-10 shaker conveyor; 5-hp. motor, 500 volts, d.c.; Approval 271A; Oct. 17.

Deming Co.; "Oil-Rite" mine pump; 7½-hp. motor, 250 and 500 volts, d.c.; Approvals 272 and 272A; Oct. 23.

ment campaign. W. H. Davis, former deputy administrator and later director of compliance, was called back to Washington to make a special study of the problem. Sol A. Rosenblatt, division administrator, was named national compliance director, and A. G. McKnight, director of the litigation division, was made special assistant general counsel to survey the legal aspects of enforcement. Plans were put in motion for immediate decentralization of field activities through the establishment of ten regional offices under the supervision of Mr. Rosenblatt.

The Davis report, now under consideration by NIRB, recommended:

1. The gradual development of the *labor* compliance machinery of the compliance division into a single-duty regional code labor enforcement service.
2. Giving to the code authorities the initiation of and primary responsibility for enforcement of fair competition code provisions, subject to supervision by field representatives of a code administration service responsible through the administrative divisions of NRA to the NIRB.
3. Opening up and keeping open free channels of access to the statutory law enforcement agencies from the regional agencies of the code labor enforcement service and from the code authorities.
4. The classification of unfair competition code provisions into (*a*) those which forbid practices generally recognized as evil in themselves or the prohibition of which has been approved by firm judicial precedent, and (*b*) those which are made unlawful only by the prohibition of the codes and which have not yet received judicial sanction; followed by the adoption of different enforcement procedures applicable respectively to these two classes of provisions, district attorneys being specially aided in Class 2 cases by NRA litigation specialists.

While the Davis report insists that the government must assume the responsibility for enforcement of code wage and hour provisions, the code labor enforcement agency "should function primarily in codified industries which now have no labor compliance agencies of their own. It is clear," the report emphasizes, "that no established machinery which is now getting results in any particular field of compliance should be superseded by new machinery until that new machinery has achieved at least equally good results in other fields." Enforcement of Sec. 7(a) of NIRA, declares Mr. Davis, "is a matter for the Labor Relations Boards and needs no discussion here."

Price-fixing provisions of the bituminous code were upheld on Nov. 19 when U. S. District Judge Gore, at Nashville, Tenn., vacated a restraining order issued Sept. 6 and declined to grant a temporary injunction restraining the enforcement of the minimum code prices against V. J. Daugherty, receiver of the Fentress Coal & Coke Co., Wilder, Tenn. The same week a consent decree was entered against East Kentucky Coals Sales, Inc., for violation of the price provisions, and on Nov. 27, U. S. District Judge Nevin, at Cincinnati, Ohio, fined the defendant $50 on each of two counts charging sales below the minimum. Earlier in the month, a consent decree restraining the Eldnar Coal Corporation, Belleville, Ill., from violating the price provisions was entered by U. S. District Judge Wham at East St. Louis, Ill.; the criminal information in this case, filed Oct. 30, contained seven counts.

As a result of investigations conducted by field representatives of the Illinois subdivisional code authority, Federal Trade Commission examiners and attorneys of NRA, criminal informations also were filed against officers of the Morgan Coal Co., Milstadt, Ill. A trial is scheduled for this month. Other investigations have been under way in Illinois, Kansas, Kentucky and Ohio, and further prosecutions are anticipated.

Provoked by cash discounts offered by wholesalers in competitive bidding, Division V has renewed its plea that wholesalers be brought under the producers' code in the Rocky Mountains region. Protest also was entered with Washington by the same division late in October against the action of the Maple Creek Coal Co., now in receivership, which announced at a rehearing of a case involving discounts and classifications, held before the Utah subdivisional code authority, that it had entered into a contract with a second party to sell all its output not otherwise contracted for. Because, under the bituminous code, the second party is not making "an original sale," the divisional code authority contends that, if the transaction stands, the second party is at liberty to sell at any price it sees fit.

Following the appointment of a special committee of NRA personnel, to act on requests for declarations of emergency in the retail solid-fuel industry on Oct. 30, the jam of accumulated applications for such declarations was broken. During November, the committee, headed by Deputy Administrator Frank A. Hecht, approved 56 cost determinations covering prices in 112 counties and cities in 15 States.

A national retail solid-fuel code authority was announced by NIRB on Nov. 23 to succeed the authority which resigned in a body early in September (*Coal Age*, October, 1934, p. 400). The new authority includes four members nominated by the National Retail Coal Merchants' Association, with another to be named; four voting and three non-voting members selected by NIRB. Under the new set-up, the voting membership was increased from seven to nine. Voting appointees of NIRB include two representatives of the truckers.

Undeterred by the action of NRA in denying their petition for the restoration of the 8-hour day and the privilege of working six days a week when work is available, Rocky Mountain operators are continuing their fight for relief from the inflexibility of the existing code provisions on maximum hours. The brief prepared by the special committee of the Rocky Mountain-Pacific Coal Association for submission to NRA Nov. 10 has since been reprinted and sent to all Western Congressmen and governors and to all official labor and NRA representatives in Washington. The National Coal Association also has circulated copies to its membership.

Utah Cardox Decision Stands

Continued use of Cardox in breaking down coal while men are in the mines was indorsed in a 2 to 1 division of the Utah Industrial Commission last month, which refused to revoke the resolution permitting the practice, adopted two years ago after a hot contest. Reaffirmation of the stand of the commission grew out of a petition filed by union representatives, on which hearings were held in May.

Industry Mapping Programs For Future Controls

Organized industry throughout the country has been unusually active in recent weeks shaping programs to chart the business course after the expiration of NIRA next June. Definite declarations of policies are planned by the National Association of Manufacturers, which has called a general Congress of American Industry to meet in New York City, Dec. 5-6, to act upon proposals worked out by special committees of the sponsoring organization (*Coal Age*, October, 1934, p. 401). Proposals drawn up by the NRA committee of the Chamber of Commerce of the United States were made public last month and submitted to the Chamber membership for referendum vote.

The special legislative committee of the National Coal Association held several meetings last month and planned to hold a final session on Dec. 5, prior to submitting its report on permanent legislation to the directors of the bituminous operators' organization the following day. Following the policy adopted in the presentation of its interim report at the convention of the association in October, the committee has given no public inkling of its proposals for permanent "control of overexpansion of productive facilities." Rumors that one of the plans under discussion calls for the purchase of marginal capacity with government funds to be repaid by a tonnage tax, however, already have provoked subterranean rumblings of opposition both inside and outside of the industry.

While the National Association of Manufacturers has submitted a general platform for recovery covering national planning, public and private finance, government competition with business, industrial relations and social security, chief interest probably will center on the report of the organization's committee on future relations of government to industry. Recognizing the desirability of some temporary controls after the expiration of NIRA, the committee would divorce labor and fair-trade practice administration and have two separate emergency acts. The first, dealing with labor problems, says the committee, should be administered by the Department of Labor.

Creation of an independent administrative court of five members is suggested for the temporary fair-trade practice act. Establishment of codes should be voluntary and the application of the act should be limited to industries engaged in or directly affecting competition in interstate commerce. Marketing agreements, price-fixing and limitation of output would be barred except where approved by the administrative court as in the public interest and carried on under adequate governmental supervision. While the administrative court could approve or disapprove codes submitted, it would be without authority to write such codes either in whole or in part. The committee recognizes that special treatment may be necessary for natural-resource industries, but adds that "the greater the privileges extended and the more nearly the results approach or tend toward monopoly, the greater the governmental supervision that is necessary to protect the public interest."

The Chamber of Commerce referendum follows the general lines of its NRA committee report as summarized in the Octo-

ber issue (p. 401). It is in agreement with the proposals of the National Association of Manufacturers on voluntary codes. Unlike the latter plan, however, the chamber program does not separate the labor and fair-trade functions or call for two separate laws to govern them.

Illinois to Use Cement Made With State Coal

As a result of representations by the Southern Illinois Reciprocal Trade Association, organized last summer to promote the use of southern Illinois coal, purchases of cement for road construction in Illinois will be confined to mills using Illinois coal, it is reported. These mills may be located either within or without the State. The subject was first broached to Governor Horner by a committee of the association on Oct. 15, which pointed out that there was a strong possibility that a number of mills now using natural gas would go back to coal if the program was adopted.

Scrip Limitation Proposed

Limited acceptance of scrip, at not less than its par or face value has been recommended as a fair trade practice for all types of retail outlets in the report of a special committee appointed under the provisions of the retail code. Committee recommendations were divided into two groups, the first of which would eliminate Art. IX, Sec. 4 of the retail code in favor of the following:

No company store or retail store shall collect by offset in the form of scrip, book credit or otherwise, against the wages of any person other than its own employees engaged exclusively in the retail trade, an amount for merchandise sold by said store in excess of 25 per cent of such pay earned in any pay period.

No store shall purchase or receive or accept for cash or consideration in trade or in payment of indebtedness any scrip at less than its par or face value.

The committee's second group of recommendations is "designed to carry out the spirit of the first group," which would apply only to the retail trade, and to "indicate some considerations involved in correcting some of the evils which now exist in connection with the company store and the scrip system." These supplemental suggestions involve the adoption of regulations which would:

(1) Insure that the worker receive a reasonable portion of his wages in cash on each pay day; (2) limit the pay period to one week, and limit pay hold-backs to a maximum of one week; (3) prohibit any employer of labor from requiring an employee to trade at the company store; and (4) prohibit the payment of wages due in any form other than lawful money or par checks.

No action has been taken on the report by the NIRB, to which it was presented, and the scrip provisions of the various codes have been stayed to Jan. 6, 1935, to allow study of the report. Recommendations of the committee were vigorously opposed by the National Coal Association before the NIRB and the NRA Industrial Advisory Board. Similar protests, it is reported, have been made by the United Mine workers to the NRA Labor Advisory Board.

TVA Encounters Hard Sledding in Courts; Williams Replies on Investigation

TVA continued as the principal target in the bituminous industry's war on competitive fuels and sources of energy, which gathered increased headway in November. Developments during the month included a number of decisions by courts and public service commissions in Alabama and Tennessee, where coal and ice men are attacking on a wide front, and a reply by J. P. Williams, Jr., president, National Coal Association, to the proposal of Dr. A. E. Morgan, chairman of the TVA board of directors, for an investigation into the relative merits of coal and waterpower as sources of electrical energy. Public-utility companies, through the Edison Electric Institute, also entered the lists against TVA and the federal hydroelectric program, threatening court action, and Appalachian Coals, Inc., issued "Debunking the TVA," a 22-page pamphlet designed as a vehicle for wide dissemination of the industry's analysis of the effects of the government's program on coal and industry and society in general.

Through injunction proceedings, the coal and ice industries of Tennessee successfully blocked the sale of utility properties of the Tennessee Public Service Co. in Knoxville and vicinity to TVA, but their success was offset by a proposal that the city build its own distribution system with PWA money. First blood was drawn by the coal and ice men when a State Circuit Court order restraining sale of the properties was granted late in October, and was sustained by the Supreme Court, which refused to review the action of the Circuit Court. On Oct. 31, following the refusal of the federal court to grant an injunction blocking the sale, State Court Judge E. F. Langford granted the application of the coal and ice industries for a review of the action of the Tennessee Railroad and Public Utilities Commission in approving the sale of the properties in question. As the deadline for the sale was Oct. 31, this action prevented its consummation, and on Nov. 2, David E. Lilienthal, a TVA director, declared negotiations for the acquisition of the properties at an end. Subsequently, Knoxville city officials embarked on plans for building a municipal distribution system, to be financed out of a prospective PWA grant of $2,600,000.

A second sale of Tennessee properties, in this case by the Tennessee Electric Power Co. in the eastern part of the State, also was attacked in November by coal and ice companies, who requested the utility commission to refuse approval of the project in a petition presented on Nov. 16. TVA countered with a plea for dismissal of the petition on Nov. 27, on the ground that the petitioners had no interest in the subject matter of the proceedings.

A federal court ruling following close on the Nov. 24 decision of the Alabama Public Service Commission approving sale of Alabama Power Co. properties in fourteen communities in the northern part of the State to TVA gave protesting coal and ice men much hope of eventual success in their fight to prevent consummation of the transfer. The ruling in question was made on Nov. 28 by Federal Judge W. I. Grubb in denying a TVA motion to dismiss the application of fourteen holders of power company preferred stock for an order restraining the sale. (A similar case brought by the coal and ice interests was still pending in November.) The right of TVA to produce and sell electricity, Judge Grubb held, depends on whether it merely salvages excess waterpower as an incident to other operations or whether it engages in power production and distribution as a primary enterprise.

"The scope of the project of the Tennessee Valley Authority, as outlined by its directors, as it is being administered by them, forbids the plea that its purpose in dealing with electric power is for the salvaging of a surplus to prevent its waste. On the contrary, its disclosed purpose is to furnish an example of government operation of electric power production in the interest of public operation and ownership of such utilities, and also to furnish physical aid to a social experiment being conducted by the Authority in the Tennessee River Valley, for the improvement of the race." TVA was given twenty days in which to answer the questions raised in the decision, thus clearing the way to a trial of the suit.

Expressing the coal industry's willingness to cooperate with TVA in selection of competent disinterested investigators to analyze the Authority's activities, Mr. Williams, in a letter dated Nov. 14, disagreed with Dr. Morgan on some of the points proposed for investigation. Reiterating the industry's right to protest against the government's entrance into the field of private business, he questioned the economic soundness of the TVA program and asked if its officials would abide by the results of the investigation. The text of Mr. William's letter, in part, is as follows:

The coal industry welcomes the opportunity to unite with the Tennessee Valley Authority in selecting a body of competent, disinterested investigators to make an impartial investigation of TVA activities. We cannot, however, agree with you that the points outlined in your letter are the proper ones for investigation. Taking up these points one by one, I will try to answer them as briefly as possible.

"(1) The cost of electric power generated by the Wilson, Norris and Wheeler dams, with such standby steam plants or such additional water storage as may be economical. In this estimate, the war-time development at Muscle Shoals would be appraised at a fair present value and not at the total investment made under war-time conditions for military purposes."

To this we have no objection providing that all elements of your true cost are taken into account, including your deduction for navigation and flood control and your subsidies by way of tax exemption, interest escapement, freight rate discounts, etc.

"(2) The actual cost of coal as mined within reasonable transmission distance of these dams, including indirect government subsidies, if any, to the coal industry, in the form of relief of underpaid or destitute mine workers, and other forms of subsidy. This investigation should include the total actual cost of coal, including its social costs, due to anti-social working and living conditions, if any, within coal-mining communities, and what the total cost would be if the coal miners were paid living wages equivalent to the standard paid in the construction of hydro-electric properties and in their operation."

To this we object and resent the intima-

tion that coal miners are receiving any more indirect government subsidy in the form of relief than any other class of workers. The relief records will show, and you must be familiar with the fact, that the larger portion of relief is going to the urban centers and not to isolated mining communities. The fact that mining communities are for the most part in isolated areas has made it necessary, in many instances, for the mining companies to give free rent and food in times of unemployment, a cost that few other industries have to bear.

We further resent the words, "if miners were paid *living wages* equivalent to the standard paid in the construction of hydro-electric properties and in their operation." That is manifestly unfair. You may as well compare miners' wages with automobile mechanics in Detroit. The facts are that miners are paid better wages than workers in the steel, textile and many other industries and the whole matter was threshed out in code hearings before NIRA in Washington in the summer of 1933.

As to the total cost of producing coal, these figures have been filed in detail with the NIRA by the various code authorities and I am sure would be available to any competent, disinterested investigators, such as you suggest.

"(3) The extent to which steam plants are paying less than the market prices for coal by means of buying 'distressed' coal."

This question hardly needs answering, if you are to deal with cold business facts and not some visionary scheme. The steam plants will pay the ***market price*** of coal, regardless of whether it is "distressed" coal or "premium" coal. The market price in any area over the past several years can easily be determined.

"(4) The actual cost at present of generating power in the actual steam plants within transmission distance of the three dams mentioned; also what the cost would be of abandoning the present steam plants, paying off that capitalization, and building new and modern steam plants in accordance with the best modern practice."

This question is ambiguous. Ostensibly there is a market for electric power in the Tennessee Valley, or you propose to create one. You have undoubtedly located your hydro-electric stations at the most economic and favorable points for such development. If we are to have a fair comparison the investigators should have the right to locate the hypothetical steam plant at the most economic point for steam generation, and to serve the market, and not necessarily within transmission distance of the three dams.

I do not see that the cost of abandoning present steam plants has anything to do with the matter, unless it is the intention of TVA to compensate present owners of these plants. If that is the case, then the steam plant should do likewise.

"(5) The cost of meeting additional requirements for power in this region by the construction of additional steam plants of modern design; and the comparison of this cost with the cost of hydro-electric power generated at the three dams mentioned."

I see no objection to this.

This industry has a perfect right to protest against the federal government going into a private business which will hurt our industry tremendously. It is generally recognized that TVA is a pioneer in this development and, if successful, similar developments will be made in many parts of the country. It is only fair and proper that the facts be known. Is there a proper economic justification for TVA development? Are the rates fair and will they return a reasonable earning on the investment, or will the taxpayers' money continue to be poured into this development to keep it alive? In other words, can TVA ever stand on its own feet, or can it only be kept alive by government subsidy?

November also brought an announcement that TVA had authorized the construction of a $22,000,000 navigation and flood-control dam on the Tennessee River near Pickwick Landing, southern Tennessee, including provisions for the future installation of generating equipment with a capacity of 204,000 kw. In the meantime indications that proponents of the government's hydro program would press for its extension multiplied last month. Senators McKellar and Bachman, of Tennessee, announced that they would work for an appropriation by the next Congress of $250,000,000 for TVA to enable the entire program to get under way as quickly as possible. The Great Lakes-St. Lawrence Tidewater Association, in a post-election statement, phophesied prompt ratification of a "new" St. Lawrence waterway treaty in the Senate, and a few days later a New York Power Authority report, widely publicized from the White House, foreshadowed a shift from the water-transport to the power production angle.

Further evidence of the sentiment at the White House was afforded in a statement by the President in the course of an address at Tupelo, Miss., Nov. 18, that the joint TVA-Tupelo distribution set-up would "be copied in every State of the Union before we get through." On Nov. 29, Representative D. D. Terry, Arkansas, announced that he would propose in the next Congress the establishment of an Arkansas Valley Authority similar to TVA for the Arkansas and White rivers. Officials of the Mississippi Valley Association, he stated, have offered their cooperation. Mr. Terry's plan was reported to be similar to that of Representative W. E. Disney, Oklahoma, except that it would not stress navigation on the Arkansas.

Active promotion of the $40,000,000 Santee Cooper waterpower project in South Carolina before the PWA was undertaken by a State power authority created by the State Legislature last year to take over this project from the private owners and previous applicants for a PWA loan. Danville (Va.) city fathers met still another reverse in their attempts to put through a bond issue of $2,225,000 for the construction of a hydro-electric plant on the Dan River with PWA funds, when the State Supreme Court of Appeals refused, on Nov. 23, the city's petition for an order compelling Henry Leigh, Corporation Court Judge, to sign a writ for a new election on the issue.

"Equal emphasis" on coal as a heating medium was urged on the Federal Housing Administration last month by the National Coal Association, which pledged the aid and cooperation of the industry in the government's home modernization and building program. Modern coal-burning house-heating equipment has an important relation to this program, the association pointed out, and is now available for handling and burning coal as efficiently as either gas or oil, and at far less cost.

Fight Alabama Tonnage Tax

An aggressive campaign to abolish tonnage taxes of 2½c. on coal and 4½c. on iron ore has been launched by Alabama iron and coal producers under the leadership of the Alabama Mining Institute. These levies were blamed for a large part of the decline in production of these two commodities by James L. Davidson, secretary of the institute, who stated that the United Mine Workers also has voiced solid opposition to the taxes.

Stokers Make Wide Gains In Birmingham Market

The coal stoker has almost eclipsed oil in the fight for the automatic heat market in Birmingham, Ala., it is reported, although distribution of natural gas still is being pushed with rental of conversion burners and guarantee of the first year's heating bill as inducements. Stokers were not offered in Birmingham until two years ago, while oil and gas started their campaigns as far back as 1929, but in spite of this handicap it is estimated that more than 200 stokers have been installed during the early fall months of this year by the half dozen firms in the business. One concern alone expects that its sales during the present heating season will reach the 200 mark.

Evidence of the advance made by stokers, according to observers, is the fact that oil failed to exhibit at all at the recent housing exhibit held under the sponsorship of the Federal Housing Authority, the gas company being the only competitor of coal to have a display. Stokers, on the other hand, were demonstrated by the George F. Wheelock Co.; Clark & Jones; Sears, Roebuck & Co.; and the Arnold Supply Co. The Mac-Wates Fuel Co., retail agency of the Brilliant Coal Co., joined with the Wheelock organization in extolling the merits of automatic heat with its stoker coal, thus supplementing its newspaper and direct-contact campaign of several weeks' standing. Results of the program, Brilliant officials report, include a 50 per cent increase in stoker-coal sales so far in the 1934 heating season, as compared with the 1933 season. This contrasts with very little improvement in sales of other grades.

Stoker Display at the Recent Birmingham Housing Exhibit.

National Labor Board Decides Five Cases; Anthracite Factions Continue Fight

FIVE cases were brought before the National Bituminous Coal Labor Board at a series of hearings in Washington, D. C., early in November. In the Edgewater Coal Co. case, appealed from a decision of the Division I—South Labor Board as a result of a controversy over the divisional board's jurisdiction, the national board decided to render a decision and refer it to the NRA for further action. In the hoisting engineer's case, appealed from Division II, the board upheld the divisional board's decision that contract provisions had not been changed by the code except to the extent agreed upon by the parties thereto, and that engineers were therefore excepted from the 7-hour provision. Both parties withdrew at the hearing before the national board, which therefore sustained the division ruling.

The Division II ruling that the United Mine Workers, rather than the Knox County Miners' Association, was the proper representative of the employees of the Knox Consolidated Coal Corporation, Bicknell, Ind., was upheld by the board. Carrying out this decision, the operator signed an agreement with the United Mine Workers immediately, and the local Knox County organization was dissolved. The national board also took up two cases brought by the Union Pacific Coal Co., Rock Springs, Wyo. In one case, involving wages and hours in pumping plants operated 24 hours a day, decision was withheld, pending the filing of further briefs as to the interpretation of the code clause dealing with this particular subject with the NRA. In the disagreement over whether 7 or 10c. per ton should be the increase for pit-car loaders, the national board sustained the divisional board's conclusion that 7c. was proper, but stipulated that the decision was not to stand as a precedent, applying only to the two mines involved.

A number of decisions were handed down by the Division I—North Labor Board late in October, as follows: Berthy Coal Co., Cowan, W. Va.—driving an entry or tunnel does not constitute new development, and wages and hours for the work must conform to the code and wage agreement; W. J. Rainey, Inc.—drivers at the Allison and Royal mines, in Pennsylvania, must harness and unharness livestock as part of their work; Cambridge Collieries Co., Ohio—question of payment of separate compensation for setting of cross bars, brought up by District 6, United Mine Workers, is a matter that must be settled by the joint scale committee in that district; Robert Gage Coal Co., Bay City, Mich.—shaft sinker receiving $4.88 per day continued to receive this amount after the shaft reached coal, although the inside day rate was $4.60. A wage increase of 40c. per day went into effect April 1, and the employee in question contended that his new wage should have been $5.28. The board, however, established his rate at $5.

Robert Gage Coal Co.—position of night fireman discontinued, and employee offered a day shift job at the same wage, which he refused. Board ruled that employee should have accepted, and that the company should renew the offer at at least his former wage; City Coal Co., Glenwood, W. Va.—rate provided in agreement should be paid for breast-machine cutting and if deficiencies exist the question should be handled in accordance with existing wage agreement; Costanzo Coal Mining Co., Wheeling, W. Va.—five workers employed part time at slate picking and the remainder at general outside work shall be continued at $4 per day; St. Mary's (W. Va.) Sewer Pipe Co.—management of captive mine must meet chosen representatives of its employees for collective bargaining according to Art. V of the code; W. F. Wetzell, Canfield, Ohio—must pay all miners working during the period Oct. 2, 1933-Feb. 6, 1934, the rate set out in a supplemental agreement for the Salem-Leetonia district, to which he was a party. All former employees are at liberty to apply for work and must be taken on within 30 days. Valid contract with the United Mine Workers exists.

Other Decisions Handed Down

The Division I—South Labor Board handed down three decisions late in October. In the complaint of the United Mine Workers that the Big Run Coal & Clay Co., Inc., Ashland, Ky., was attempting to evade collective bargaining with the union by leasing its coal property to its former superintendent, the board directed that code wages and hours be observed in the mine opened by the superintendent, and recommended that the matter be referred to the NRA Compliance Board if written notice of compliance was not received in ten days. A similar decision was handed down in the case of the Whited Coal Co., Swords Creek, Ky., and the board further ordered that a charge of selling under code prices be referred to the code authority. Charges that the Harlan-Wallins Coal Corporation had discharged employees at its Molus and Verda (Ky.) mines for posting notices calling for the election of a checkweighman, preferred by the United Mine Workers, resulted in a decision that the company had violated the code, and should be cited to the NRA Compliance Division.

Another attack on the Progressive Miners of America in Illinois got under way Nov. 16 with the filing of a petition by the United Electric Coal Co. in the federal court at East St. Louis for an injunction restraining the insurgents from interfering with the operation of the company's strip mine at Freeburg, Ill., where operations have been attempted with members of the United Mine Workers as employees. Earlier in the month, the same court ruled that members who withdrew from the United Mine Workers to join the Progressives lost all rights to participate in or benefit from the United Mine Workers Medical Relief Association of West Frankfort. This ruling was made in awarding custody of a safe-deposit box containing $17,099 of the association's funds, claimed by the Progressives, to the United Mine Workers. William Keck, East St. Louis, gained the nomination for the presidency of the Progressives without opposition, and will take office Dec. 4 in the absence of an opponent. He will succeed Claude Pearcy, first president.

Notice of the absorption of another independent Indiana union—the Associated Miners of Indiana—into the United Mine Works was given in November through the release of the text of an agreement between the UMW and the Universal Coal Corporation, operating a mine at Universal.

Continuation of the warfare between the United Mine Workers and the Anthracite Miners of Pennsylvania for control of the northern hard-coal field found the Glen Alden Coal Co. and the Susquehanna Collieries Co. in the rôles of innocent bystanders in November. An attempt by insurgents to close the operations of the two companies resulted in a series of pitched battles between the two factions in Nanticoke in the early days of the month. The insurgents were successful in temporarily closing down a number of Glen Alden operations, but the drive, growing out of the dismissal of insurgents by Susquehanna at the insistence of the United Mine Workers, had little effect on the collieries of the latter company.

Failing in their attempt to gain their point through picketing, the insurgents turned to the local courts to secure reinstatement of members dismissed by Susquehanna. Directing their fire at the United Mine Workers, insurgents successfully prosecuted a plea for a temporary injunction protecting fourteen discharged men in applying for reinstatement. The order was made orally on Nov. 17, and was followed by a written order on Nov. 22, setting Nov. 26 as the date for a hearing on a permanent injunction. The latter hearing later was postponed to Dec. 18, and in the meantime a threat of passive resistance by UMW employees at Susquehanna operations, coupled with the insurgents' desire for a clear-cut decision, was sufficient to prevent active pressure for reinstatement of the dismissed men.

Committee of Ten Meets

Ways and means of furthering consumer satisfaction with solid fuels was the theme of the third annual meeting of the Committee of Ten—Coal and Heating Industries, held at Chicago, Nov. 27. After reviewing developments in the past year, delegates turned to the future, a number urging expansion of activities and the provision of the necessary financial support. This feeling was reflected in the adoption of a resolution urging coal-burning equipment manufacturers to give immediate consideration to a project for supplying the committee with sufficient funds to enable it to pursue field work aggressively and organize local committees in all parts of the country.

All officers were reelected as follows: chairman, John C. Cosgrove, president, West Virginia Coal & Coke Corporation, representing the National Coal Association; vice-chairman, Lyle H. Dayhoff, president, Republic Coal & Coke Co., representing the American Wholesale Coal Association; secretary, Carlyle M. Terry, Anthracite Institute; treasurer, Harry H. Kurtz, Stoker Manufacturers' Association; executive secretary, Marc G. Blurth; advisory managing director, Oliver J. Grimes, Washington, D. C.

Research Directors Named

Eight Class A directors for Bituminous Coal Research, Inc., were named last month by J. P. Williams, Jr., president of the National Coal Association, as follows: Lyle H. Dayhoff, president, Little Betty Mining Corporation; J. W. Carter, president, Carter Coal Co.; L. W. Householder, vice-president, Rochester & Pittsburgh Coal Co.; W. B. Lewis, president, Oakdale Coal Co.; W. A. Marshall, president, W. A. Marshall & Co.; H. L. Richardson, vice-president, West Kentucky Coal Co.; R. H. Sherwood, president, Central Indiana Coal Co.; and K. A. Spencer, vice-president, Pittsburg & Midway Coal Mining Co.

In addition to the association directors, seven other Class B directors were chosen at the organization meeting in October (November *Coal Age*, p. 416).

Personal Notes

THOMAS ALLEN, mining engineer and rescue expert, Grand Junction, Colo., has been appointed chief inspector of coal mines for Colorado, succeeding the late James Dalrymple. Mr. Allen served as deputy inspector from 1927 to 1930.

CHARLES E. BOCKUS, president, Clinchfield Coal Corporation, New York, has been appointed a member of a Chamber of Commerce of the United States committee for the formulation of a program for business recovery.

J. E. BUTLER, general manager, Stearns Coal & Lumber Co., Stearns, Ky., was elected president of the newly organized Southeastern Kentucky Bankers' Association on Nov. 7.

GEORGE R. COLLINS, formerly vice-president, secretary and treasurer, Winding Gulf Collieries and the Smokeless Fuel Co., Charleston, W. Va., has been elected chairman of the board of the two companies in a shift of personnel growing out of the death of Justus Collins, late head of the organizations. L. EPPERLEY, vice-president and general manager, becomes president of the collieries company and vice-president of the fuel company. H. D. EVERETT, formerly vice-president and general manager of the fuel organization, becomes president and retains his position as vice-president of the collieries company. V. H. CRITES, assistant, moves up to the position of secretary and treasurer for the Winding Gulf Collieries. ELMER WIERHAKE and H. W. BALL have been appointed sales manager and assistant secretary-treasurer, respectively, Smokeless Fuel Co.

T. P. HIGGINS has been made assistant foreman at the Slab Fork (W. Va.) mine of the Slab Fork Coal Co.

L. W. KELLY, superintendent, Clyde No. 3 mine, W. J. Rainey, Inc., resigned Dec. 1 to become general superintendent of the operations of the Cosgrove-Meehan Coal Co. of Pennsylvania, with headquarters at Johnstown, Pa.

W. M. LACEY, for several years general superintendent, eastern division, DeBardeleben Coal Corporation, Birmingham, Ala., has been appointed manager of mines for the Montevallo Coal Mining Co., Aldrich, Ala.

Harris & Ewing

Miss Josephine Roche
New Assistant Secretary of the Treasury

C. W. RHODES, president, Fork Ridge Coal & Coke Co., Middlesborough, Ky., managing director of the American Association, Inc., British-controlled mineral-land holding company, and receiver for the Bryson Mountain Coal & Coke Co. and the Fidelity Coal Mining Co., sailed on a business trip to London and Berlin on Nov. 23.

MISS JOSEPHINE ROCHE, president, Rocky Mountain Fuel Co., Denver, Colo., has been appointed Assistant Secretary of the Treasury in charge of the activities of the Public Health Service, and also will serve as the representative of Secretary Morgenthau in the solution of problems connected with the welfare of Treasury employees. Miss Roche, a graduate of Vassar and Columbia, took an active part in social service work early in life, and in 1927 purchased control of the Rocky Mountain Fuel Co., in which she already had a minor interest inherited from her father. As vice-president, she immediately signed a wage agreement with the United Mine Workers, making the Rocky Mountain Fuel Co. the only union company in Colorado until last year. Miss Roche is resigning the presidency of the fuel company, which she has held since 1929, but will remain a director.

BENJAMIN W. SNODGRASS, for several years president of the Victor-American Fuel Co., has been elected vice-president and general manager of the Moffatt Coal Co., Denver, Colo., vice the late Arthur S. White.

M. R. WHITEMAN has been appointed chief engineer for the United States Coal & Coke Corporation, with headquarters at Gary, W. Va.

W. Y. WILDMAN, Chicago, has been advanced to the position of managing director, Illinois Coal Traffic Bureau. Mr. Wildman has been succeeded as traffic manager by CHARLES W. STADELL, and HARRY A. ROZENE has been appointed assistant traffic manager.

Associations

D. A. Thomas, president, Montevallo Coal Mining Co., Birmingham, Ala., has been elected president of the Alabama Mining Institute, and the following have been added to the board of governors (September *Coal Age*, p. 367): Charles F. DeBardeleben, president, Alabama Fuel & Iron Co.; Horace Hammond, president, Alabama By-Products Corporation; and H. A. Berg, president, Woodward Iron Co.

W. J. Jenkins, president, Consolidated Coal Co. of St. Louis, has been reelected president of the Illinois Coal Operators' Association. Fred S. Wilkey and Thurlow G. Essington were again chosen secretary and general counsel, respectively, and O. M. Gordon, treasurer, Bell & Zoller Coal & Mining Co., was reelected treasurer.

Officers and directors of the Operators' Association of the Williamson Field were unanimously reelected at the annual meeting held last month. The president is L. E. Woods, president, Crystal Block Mining Co.; vice-president, C. A. Hamill, general manager, Sycamore Coal Co.; secretary, J. J. Ardigo; treasurer, J. D. McLaughlin, general manager, Earlston Coal Co.

All officers and directors of the Harlan County Coal Operators' Association were returned to office at the annual meeting, at Harlan, Ky., Nov. 21. Officers are: president, S. J. Dickenson, general manager, Mary Helen Coal Corporation; vice-president, B. W. Whitfield, Sr., president, Harlan Collieries Co.; secretary, George S. Ward.

S. M. Reams, president, Clear Fork Coal Co., Middlesboro, Ky., was reelected president of the Southern Appalachian Coal Operators' Association at the annual meeting, at Knoxville, Tenn., last month. W. G. Polk, president, Block Coal & Coke Co., Knoxville, and J. B. Gatliff, president, Gatliff Coal Co., Williamsburg, Ky., were again chosen vice-presidents, with L. C. Gunter executive vice-president.

Obituary

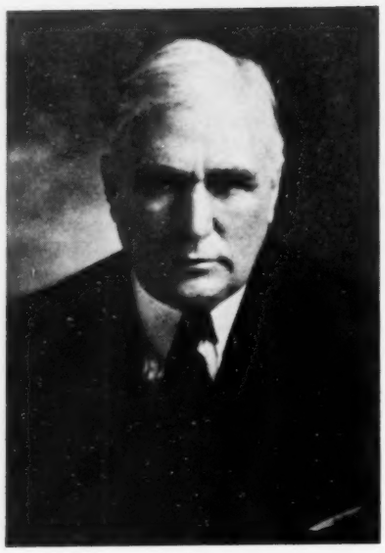
JOHN E. BAUMGARTNER, 55, pioneer operator in the Massillon, Jackson and southern Ohio fields, and president of the Massillon City Coal Co., died Nov. 2 at Massillon, Ohio, after failing to rally from an appendicitis operation a month previous.

ROBERT MACMILLAN CRANSTON, for fifteen years president of the Cranston Coal Co., Plainsville, Pa., died at his home in Kingston, Pa., Nov. 25, after an illness of seven months.

RHODES H. HICKMAN, 63, foreman of the Henry Clay mine, Edgewater Coal Co., Lookout, Ky., was killed by a fall of slate Nov. 8.

A. J. MERCER, 46, superintendent, Martwick (Ky.) mine, Greenville Coal Co., died suddenly of heart disease while on a business trip to Louisville, Ky., Nov. 20.

REMBRANDT PEALE, president of Peale, Peacock & Kerr, Inc., and the Carrolltown, Cherry Tree and Russell coal companies, operating in central Pennsylvania, died suddenly Nov. 12 at his New York City home. Mr. Peale, who was 76, was a native of Lock Haven, Pa., and a graduate of Lehigh University, supplementing his Le-



The Late Rembrandt Peale

high work with a year of law at the University of Pennsylvania before entering the coal firm of his father. He took an active part in interesting the New York Central Lines in the construction of the Clearfield, Beech Creek & Southwestern R.R., now the Pennsylvania division of the New York Central, and was active in the development of coal properties along its lines. He was appointed to the Bituminous Coal Commission in 1919 and served as an adviser to the Fuel Administration during the World War. His career was marked by activity in philanthropic and civic affairs.

PATRICK JEROME MOORE, 65, anthracite mine inspector for the past 30 years, died suddenly at his home in Carbondale, Pa., Nov. 10, after a heart attack. Mr. Moore started his career as an employee of the Hudson Coal Co. and rose to the position of foreman before entering the lists for the post of inspector, then an elective office.

CLAYTON R. MORRISON, 32, president, Clayton Coal Co., died suddenly at Denver, Colo., Nov. 13, after an operation.

MARCUS W. SAXMAN, SR., for many years a leader in the development of coal properties in the Westmoreland field of Pennsylvania and president of the Saxman Coal & Coke Co., died at his home in Latrobe, Pa., Nov. 20, after an illness of three weeks following a heart attack. Mr. Saxman, who was 66, first entered the mercantile business with his brother in 1889, and later became a partner in the coal and coke business started by his father. He later participated in the organization of the Latrobe-Connellsville and Superior companies, and after their sale conducted the operations of the company bearing his name.

Industrial Notes

AMERICAN ROLLING MILL CO., Middletown, Ohio, has established a new sales office in the Citizens & Southern National Bank Building, Atlanta, Ga., to serve the States of Florida, South Carolina, Alabama, Georgia and parts of Tennessee and North Carolina. C. M. BROOME, JR., assistant district manager, is in charge.

GENERAL CABLE CORPORATION has appointed GEORGE SHERRY to the position of general merchandise manager and H. B. TOMPKINS, formerly manager of supply sales, General Electric Supply Corporation, to the position of general sales manager.

HERCULES POWDER CO., Wilmington, Del., has appointed JOHN K. MCCABE, assistant manager, San Francisco (Calif.) office, assistant director of sales, with headquarters at Wilmington. J. B. JOHNSON, for the past five years superintendent at Hercules, Calif., succeeds Mr. McCabe at San Francisco.

HULBURT OIL & GREASE CO., Philadelphia, Pa., has appointed C. L. HALL, formerly with the Penn Machine Co., Johnstown, Pa., as its representative in the West Virginia and Virginia coal fields. Mr. Hall takes over from J. L. FERRELL, now located at St. Louis, Mo., as the company's representative in Illinois.

LINK-BELT CO., Chicago, has purchased the physical assets of the Bailey-Burrus Mfg. Co., Atlanta, Ga., and has moved all the divisions of the Atlanta office to the plant at 1116 Murphy Ave. The combined operations will be headed by I. H. BARBEE, Link-Belt engineer, formerly stationed at the Philadelphia plant.

MACWHYTE CO., Kenosha, Wis., announces the appointment of the BETZ-PIERCE CO., Cleveland, Ohio, as distributors of its wire-rope products.

REPUBLIC STEEL CORPORATION, Youngstown, Ohio, has appointed ROBERT J. WORKING as Cincinnati (Ohio) district sales manager. Mr. Working was formerly assistant district sales manager, and succeeds W. A. Peck.

TERRY STEAM TURBINE CO., Hartford, Conn., has appointed HARRY D. BEVAN to the post of manager of the Philadelphia (Pa.) district office. Mr. Bevan was formerly assistant manager of the New York office.

TIMKEN ROLLER BEARING CO., Canton, Ohio, has appointed WHITLEY B. MOORE, sales manager, to the post of general manager of the industrial division. Other appointments are: JOHN L. YOUNG, district general manager, Pittsburgh (Pa.) office, assistant general manager, industrial division; HARRY D. ROBB, sales engineer, Pittsburgh district manager; HARRY H. WOOD, since 1929 a member of the engineering and sales staff at Canton, manager of the rolling mill division, with headquarters at Pittsburgh. L. M. KLINEDINST, vice-president in charge of industrial sales since 1930, has been elected to the board of directors and advanced to the post of vice-president in charge of sales, vice Judd W. Spray, resigned. T. V. BUCKWALTER, vice-president of the bearing company for several years, has been elected vice-president and director of the Timken Steel & Tube Co.

TYSON ROLLER BEARING CO., Massillon, Ohio, announces the resignation of CHARLES E. STUART as president and treasurer. Mr. Stuart will remain on the board of directors, and is succeeded as president and treasurer by RUSSELL E. COLGATE, chairman of the board. RALPH E. MAXSON is executive vice-president in charge of operations; GEORGE C. MCMULLEN is vice-president in charge of sales; GEORGE NEUPOWER, secretary; and E. R. EARNEST, assistant treasurer and purchasing agent.

Mine Death Rate Drops

Coal-mine accidents caused the deaths of 72 bituminous and 25 anthracite miners in October, according to reports furnished the U. S. Bureau of Mines by State mine inspectors. This compares with 72 bituminous and 17 anthracite fatalities in September, and 70 bituminous and 29 anthracite deaths in October, 1933. With a production of 32,573,000 tons, the bituminous death rate in October was 2.21 per million tons, against 2.60 in September, when 27,670,000 tons was mined, and 2.36 in October, 1933, in mining 29,656,000 tons. The anthracite fatality rate was 5.29 per million tons in October, based on an output of 4,729,000 tons. In September, the rate was 4.27 in producing 3,977,000 tons, while in October, 1933, the rate was 6.16, based on an output of 4,711,000 tons. For the two industries combined, the rate was 2.60 in October, against 2.81 in September and 2.88 in October, 1933.

Comparative fatality rates for the first ten months of 1934 and 1933, by causes, are given in the following table:

FATALITIES AND DEATH RATES AT UNITED STATES COAL MINES, BY CAUSES*

Cause	Bituminous: Number killed	Bituminous: Killed per million tons	Anthracite: Number killed	Anthracite: Killed per million tons	Total: Number killed	Total: Killed per million tons
January-October, 1933						
Falls of roof and coal	379	1.415	99	2.465	478	1.552
Haulage	132	.493	25	.623	157	.510
Gas or dust explosions:						
Local explosions	18	.067	10	.249	28	.091
Major explosions	7	.026	..	....	7	.023
Explosives	15	.056	9	.224	24	.078
Electricity	43	.161	6	.149	49	.159
Machinery	12	.045	2	.050	14	.045
Surface and miscellaneous	54	.202	30	.747	84	.273
Total	660	2.465	181	4.507	841	2.731
January-October, 1934						
Falls of roof and coal	419	1.417	121	2.495	540	1.569
Haulage	119	.402	22	.454	141	.410
Gas or dust explosions:						
Local explosions	14	.047	11	.227	25	.073
Major explosions	17	.058	..	....	17	.049
Explosives	23	.078	13	.268	36	.105
Electricity	46	.156	4	.082	50	.145
Machinery	14	.047	3	.062	17	.049
Surface and miscellaneous	73	.247	44	.907	117	.340
Total	725	2.452	218	4.495	943	2.740

*All figures based on current reports and subject to revision.

FOURTEENTH ANNUAL

Model Mining Number

COAL AGE

December 1934

Featuring the Operations of THE HANNA COAL COMPANY

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Vol. 39 No. 12

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EDITORIAL STAFF: Sydney A. Hale, Editor; R. Dawson Hall, Engineering Editor; Ivan A. Given, J. H. Edwards, L. C. McCarthy, Paul Wooton, Leonard Church. Willard Chevalier, Vice-President; A. W. Fisher, Manager.

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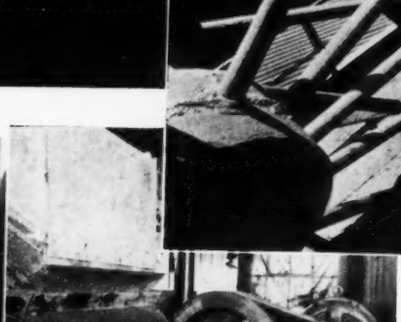
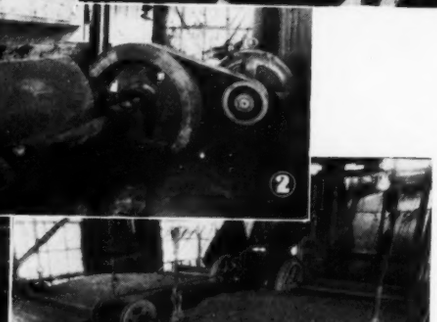




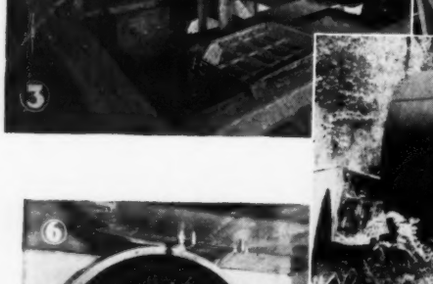
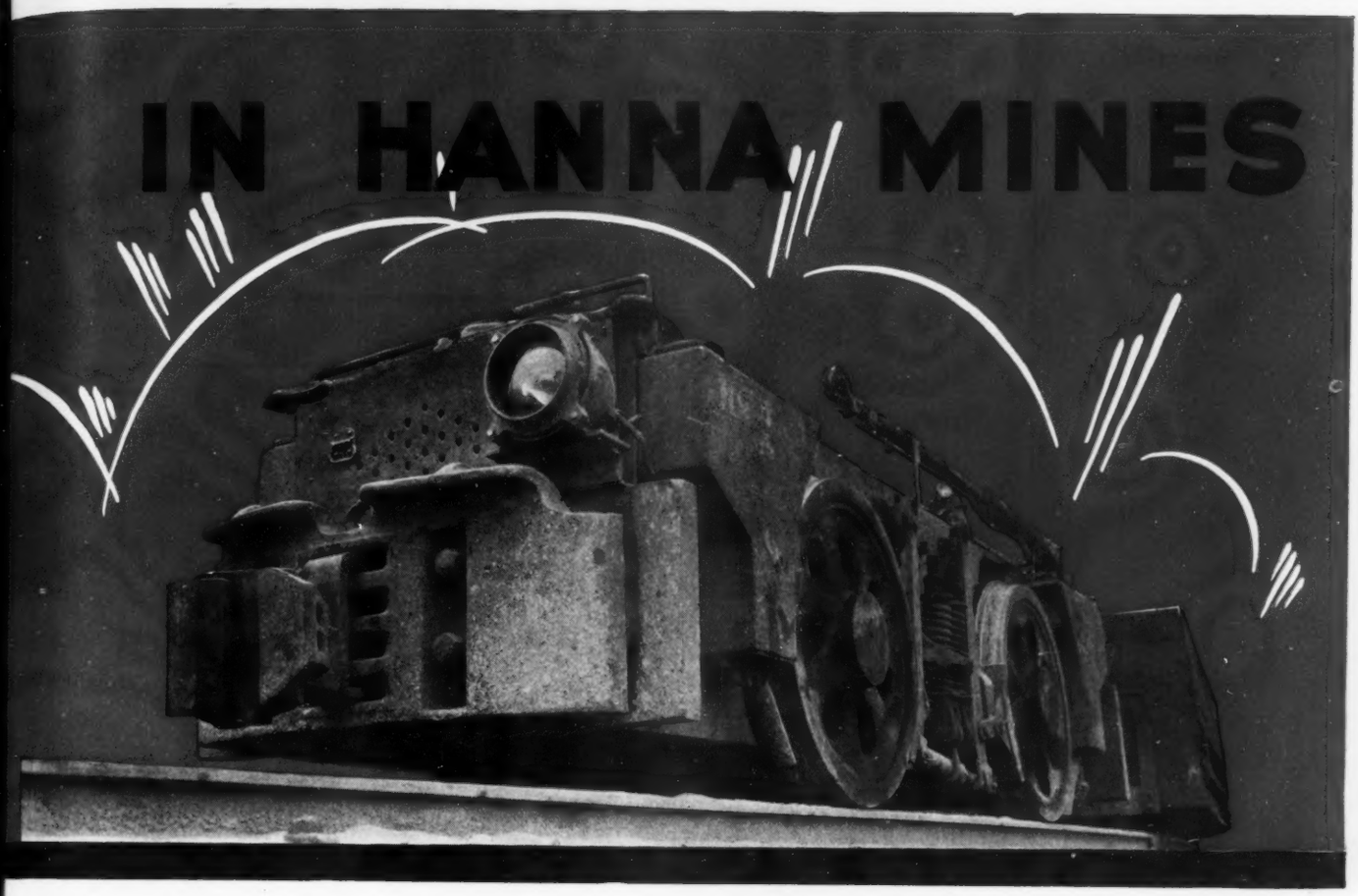


Illustration (opposite page-top) shows a Jeffrey Haulage Locomotive, typical of the 28 on duty at the Hanna Mines. This particular locomotive was hauling a 32-car trip of loaded cars upgrade, when stopped for this photograph. It negotiated the grade from a dead stop.

Illustration above shows the Jeffrey Headframe and Tipple at the Hanna No. 6 Mine, Lafferty, Ohio.

The six illustrations at the left show: 1, Jeffrey Cable Conveyor at Hanna Mine No. 1, Piney Fork, Ohio. 2, Jeffrey 36x36 Single Roll Crusher in operation at No. 6 Mine. 3, Interior of all-steel Jeffrey tipple in the No. 6 Mine. The lump, egg and slack loading booms are shown. 4, Two Jeffrey Weigh Baskets in the Tipple at No. 6 Mine. 5, One of the three Jeffrey Stepped Multi-bladed Mine Fans in service at the Hanna Mines. 6, Jeffrey Aerovane Mine Fan, a recent installation and an excellent example of this modern fan which moves more air at less cost. An Aerovane Fan will quickly pay for itself in power saving . . . keep right on saving power cost thereafter. It will replace many centrifugal fans and show similar savings, provided extreme volumes and high pressures are not required.

JEFFREY



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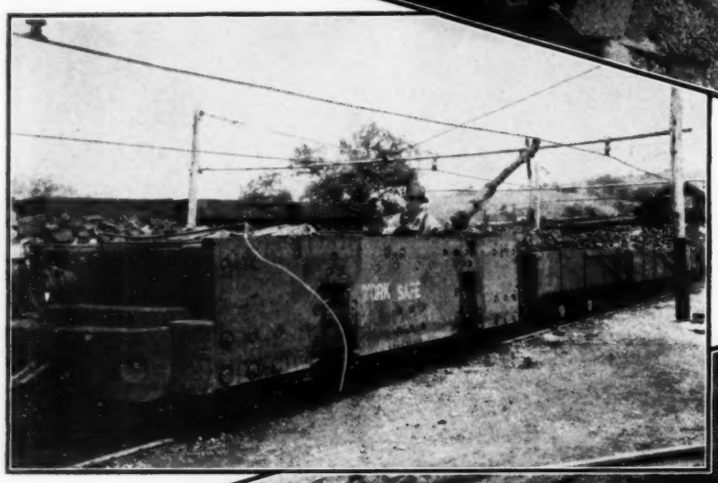
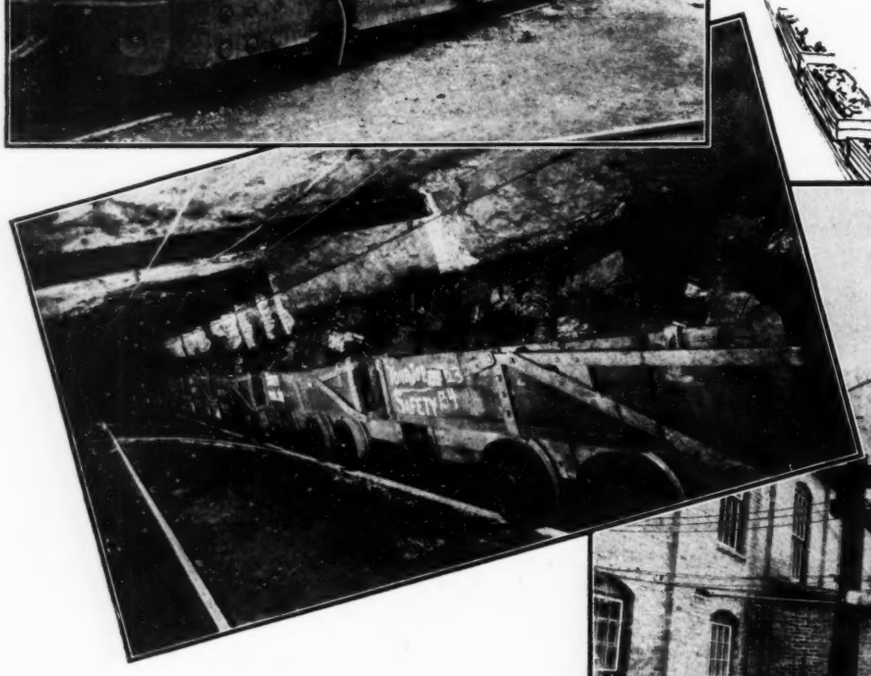
COAL MINE EQUIPMENT

18 MILES of H E

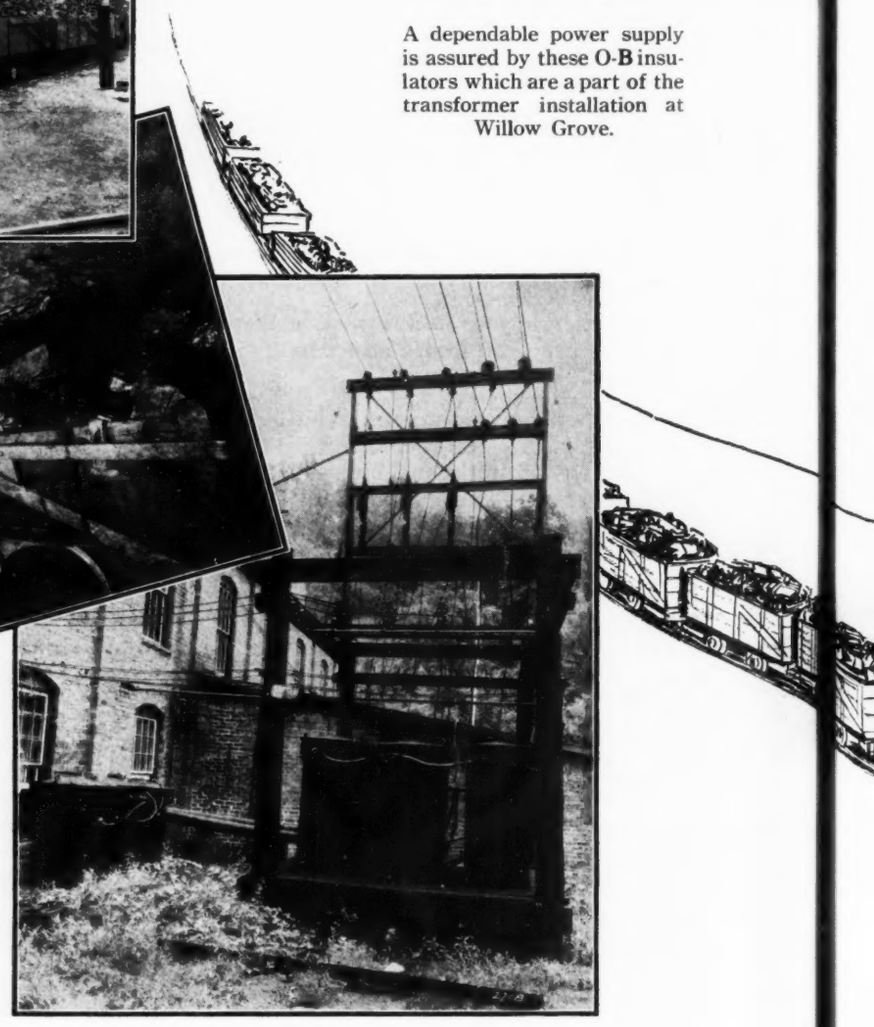
At mine No. 9 O-B Trolley Wheels and MS Headlights are standard locomotive equipment. Notice also O-B Hangers and Bulldog clamps supporting the overhead.



Heavy Duty Shoes and Harps operate effectively over lubricated wire at Piney Fork No. 1. Here also MS Headlights permit faster operation.



O-B I-Beam Clamps, Hangers and Bulldog clamps support the trolley wire underground at mine No. 6.



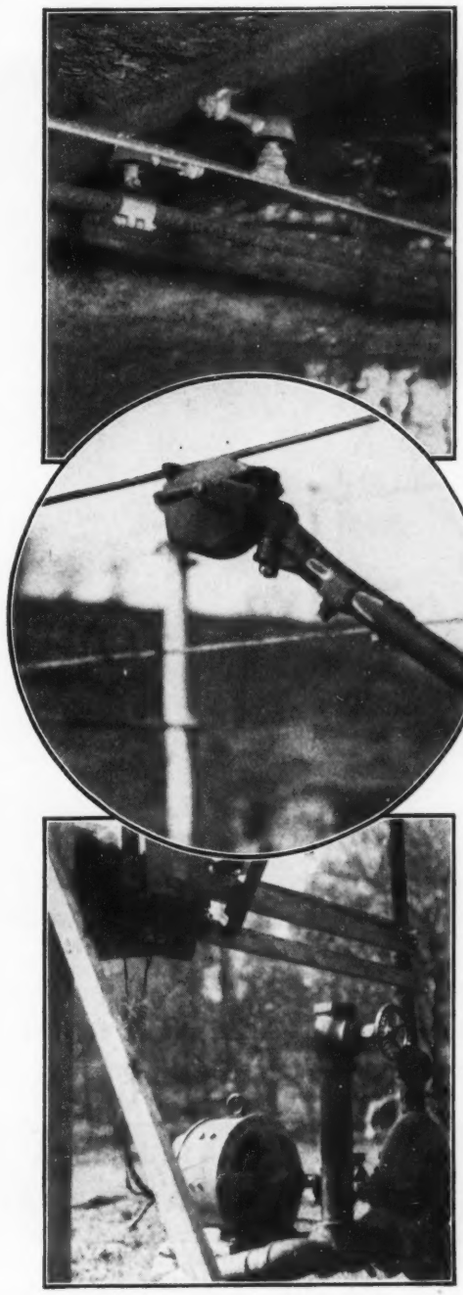
A dependable power supply is assured by these O-B insulators which are a part of the transformer installation at Willow Grove.

NRA CODE

f HAULAGE WAY *at* HANNA - - EQUIPPED *with* O-B MATERIALS

TO the Hanna Coal Company go the 1934 Model Mine Laurels, a splendid tribute to good management, capable personnel and effective equipment. Obviously the close co-ordination of all three of these important factors has made possible the remarkable results of present modernization plans which are being carried forward at the six bituminous mines included in the Hanna group.

And at Hanna, as at all of the other Model Mines, O-B overhead and locomotive equipment is an integral and vital part of the 18 mile haulage system which, this year, will transport approximately 2,500,000 tons of coal. Obviously, in an undertaking of this size there can be no haulage delays if the 2300 men, and thousands of dollars worth of equipment are to be utilized profitably. The fact that a large share of the responsibility for this continuous operation is given to O-B equipment is a high compliment to its dependability, economy and long service life.



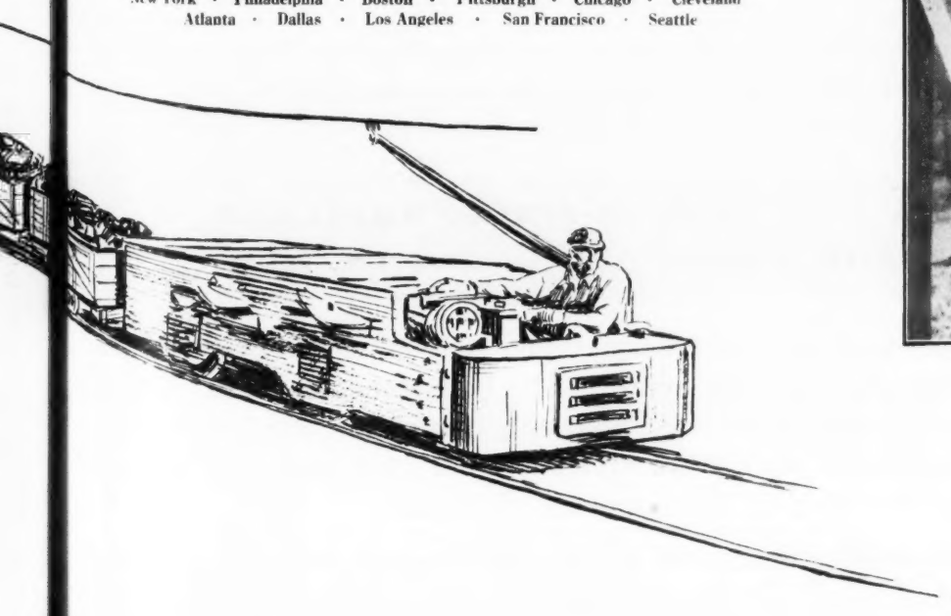
1724M

OHIO BRASS COMPANY

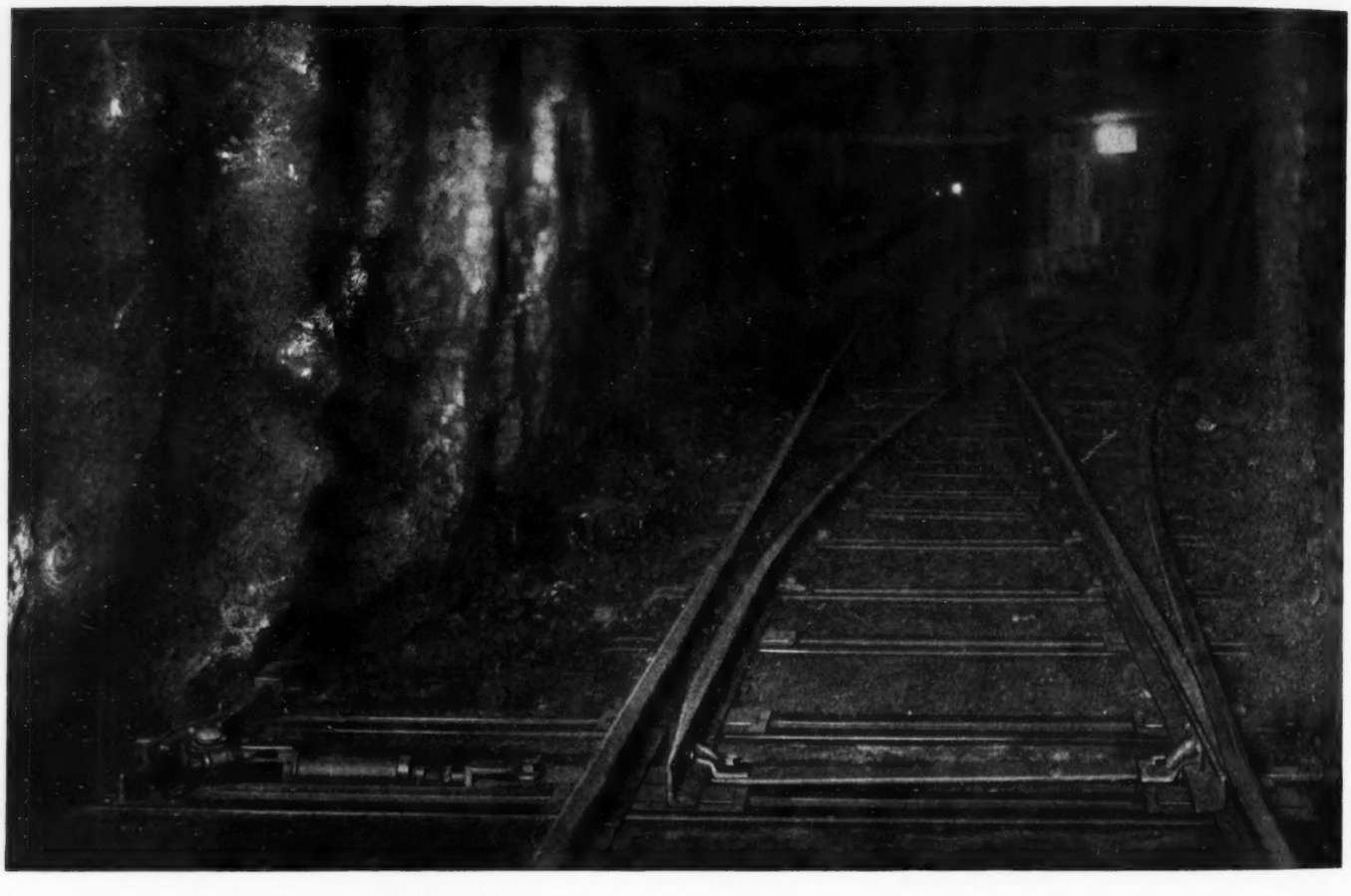
Mansfield, Ohio, U. S. A.

Canadian Ohio Brass Co. Limited — Niagara Falls, Ontario, Canada

New York · Philadelphia · Boston · Pittsburgh · Chicago · Cleveland
Atlanta · Dallas · Los Angeles · San Francisco · Seattle



Bethlehem Mine *helps to keep traffic in* Hanna Coal



IN THE MINES of Hanna Coal Company, as in many other modern mining properties, Bethlehem Mine Track Equipment is contributing to fast, safe, low-cost haulage. Among items of Bethlehem Equipment used in the Hanna Coal Company mines are:

KEYSTONE STEEL TIES **SWITCH STAND, MODEL 1217**
SOLID CAST MANGANESE FROG, DESIGN 290 **SWITCH, MODEL 395**

These items, like other Bethlehem products for mine transportation systems, embody the results of many years of experience in the manufacture of track equipment for both standard and narrow-gage railways. They are constantly being reviewed with an eye to possibilities of improvement, either in design or materials. Each item of Bethlehem Mine Track Equipment has a full measure of strength, with simplicity of design, that makes for reliability and low maintenance cost.

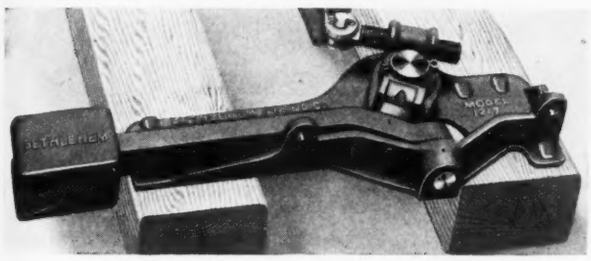
Wherever coal is mined Bethlehem Track Equipment will be found carrying the traffic efficiently and dependably, day-in and day-out, with seldom a call for attention.

Track Equipment *moving swiftly, smoothly* Company's Mines

KEYSTONE STEEL TIES—Keystone Steel Ties hold track rigidly, true to gage, with no possibility of derailments due to spreading or rolling over of the rails.

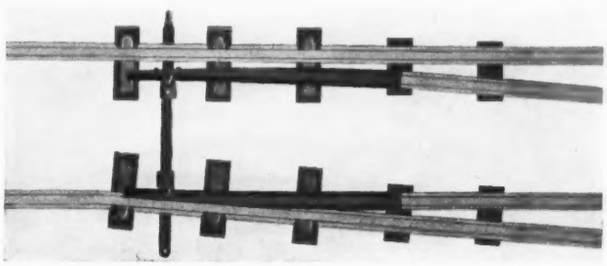
The cost of laying track with Keystone Steel Ties is low. Maintenance is negligible. No regaging or respiking. No points of inadequate rail support to cause fatigue-broken rails.

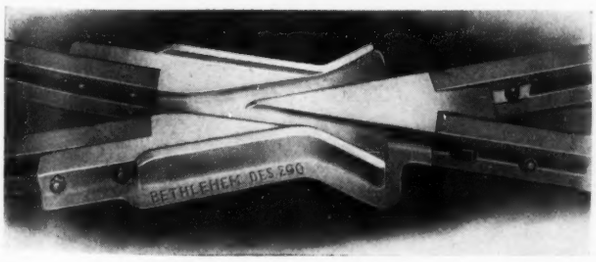
Keystone Ties are the ties for the permanent, ballasted track of main-haulage systems. Bethlehem Steel Ties Nos. 1, 2 and 3 cover other mine-tie requirements down to the lightest room track.



SWITCH STAND, MODEL 1217—This switch stand has won wide acceptance in mines because of its rugged strength, simplicity and dependability. It is of the parallel-throw type, is only three inches high, and has but three moving parts. Even where conditions are unfavorable on account of water, Model 1217 operates unfailingly.

SWITCH, MODEL 395—One of the Bethlehem line of heavy-duty switches well known for their ability to bear up under the heaviest traffic. Its construction makes Model 395 the logical switch for main-haulage track, especially where heavy equipment is used.





SOLID CAST MANGANESE FROG, DESIGN 290—Made of highly wear-resisting cast manganese steel in one piece, this frog provides long life with practically no maintenance cost. As it is flange-bearing, it is a smooth-riding frog, saving wear-and-tear on equipment.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, *GENERAL OFFICES:* BETHLEHEM, PA.

District Offices: Atlanta, Baltimore, Boston, Bridgeport, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Houston, Indianapolis, Kansas City, Milwaukee, New York, Philadelphia, Pittsburgh, St. Louis, St. Paul, Washington, Wilkes-Barre, York. *Pacific Coast Distributor:* Pacific Coast Steel Corporation, San Francisco, Seattle, Los Angeles, Portland, Honolulu. *Export Distributor:* Bethlehem Steel Export Corporation, New York.

TO BRING DOWN ITS

The Hanna Coal Company uses DU PONT Pellet Powder exclusively

THE STORY of blasting coal in the six modern mines of the Hanna Coal Company is the story of Du Pont Explosives. Du Pont Pellet Powders Nos. 2 and 4 are used exclusively in these mines.

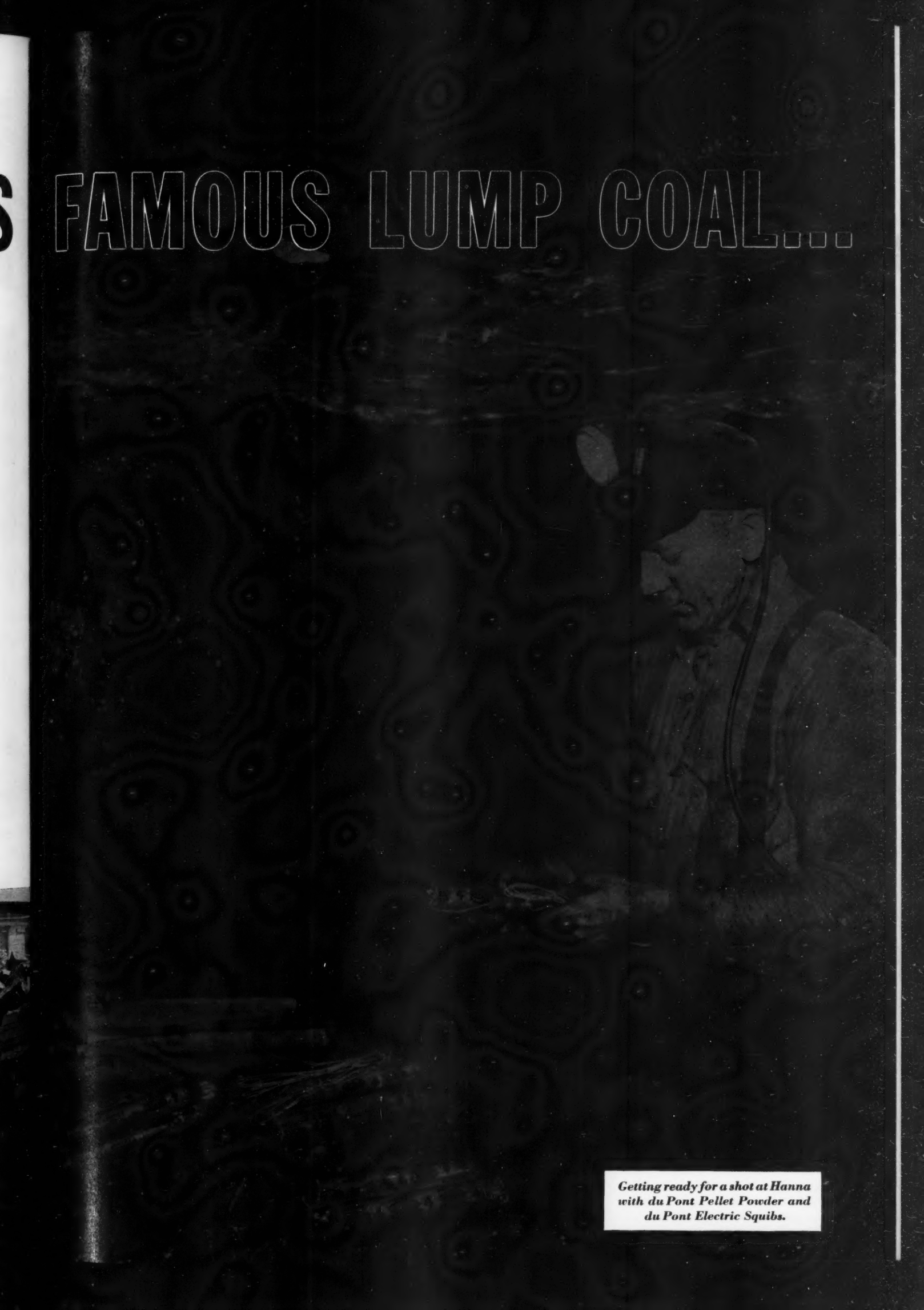
Du Pont introduced the first Pellet Powder in this country in 1925. Since that time, Pellet Powder has demonstrated its advantages over granular powder in many mines. It is safer, easier to handle, gives off less smoke, resists water better, produces better lump coal, and saves money. Du Pont now makes four grades of Pellet Powder, each of which performs efficiently in the work for which it was intended.

DU PONT
REG. U.S. PAT. OFF.

E. I. DU PONT DE NEMOURS & CO., INC.
EXPLOSIVES DEPT., WILMINGTON, DELAWARE

Hanna's good lump coal brought down with du Pont Pellet Powder.

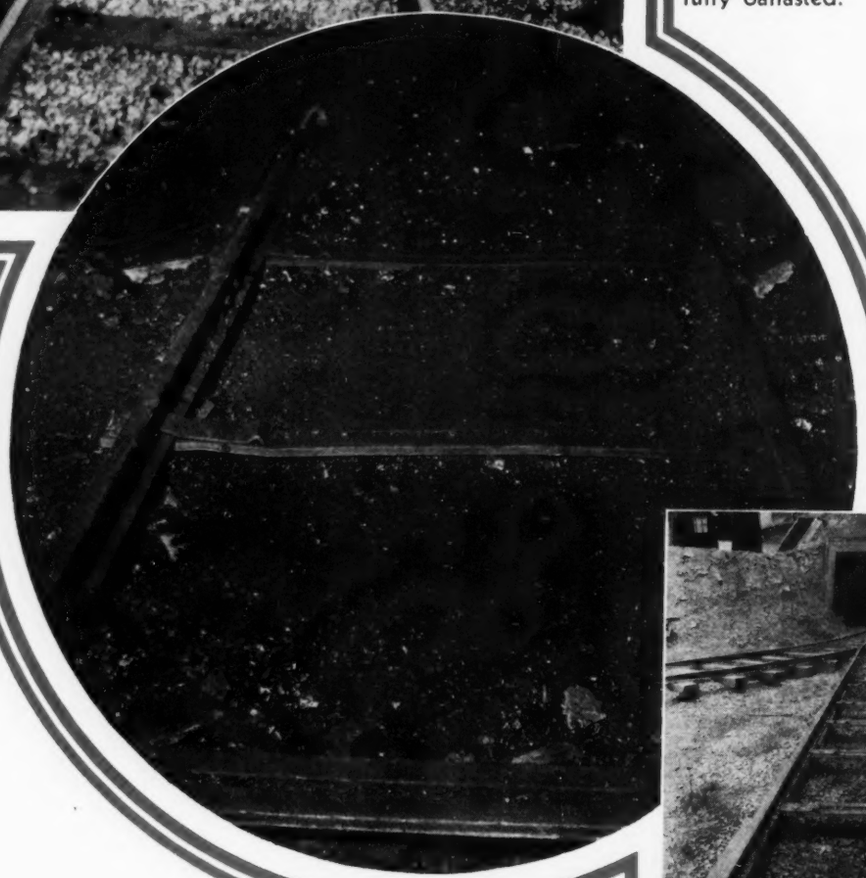
FAMOUS LUMP COAL...



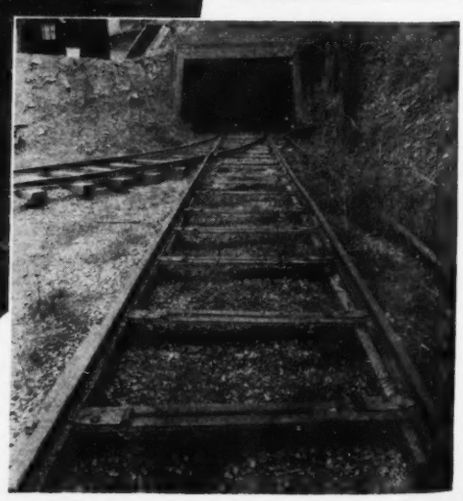
Getting ready for a shot at Hanna with du Pont Pellet Powder and du Pont Electric Squibs.

133,723

Main haulage way where Carnegie heavy tie sections M-20 and M-27 are used under 40 and 60 lb. rail. All main haulage track is fully ballasted.



In room work lighter Carnegie sections M-19-A and M-26-A are used under 25 and 30 lb. rail. Double 26-K Modified inside clips have been supplied on all recent orders.



CARNEGIE STEEL

US STEEL

CARNEGIE MINE TIES

IN HANNA PROPERTIES

"Easy to Lay — Clips Stay in Position"

The mines of the Hanna Coal Company offer splendid testimony to the efficient service of Carnegie Steel Mine Ties. 15,648 heavy Carnegie sections, M-20 and M-27, have been installed during the past six years in main haulage under 40 and 60 lb. rail — 118,075 of our lighter sections M-19-A and M-26-A in room work under 25 and 30 lb. rail. Men at the mines who lay and use these ties are enthusiastic about them. "Easy to lay. Clips stay in position. The best tie on the market," they say.

Progressive operators like Hanna realize that their track controls their tonnage. A good track eliminates tie-ups and paves the way for profitable operation. Carnegie ties are the foundation of an efficient haulage system—a long step toward modernization.

COMPANY • PITTSBURGH

Subsidiary of United States Steel Corporation

298

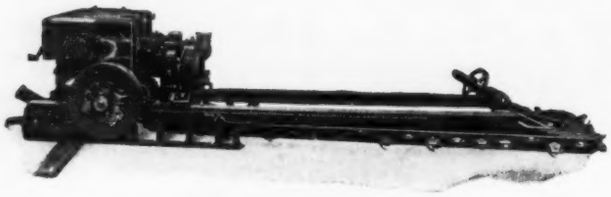
33 Years with Hanna

78 — CUTTING MACHINES — 78

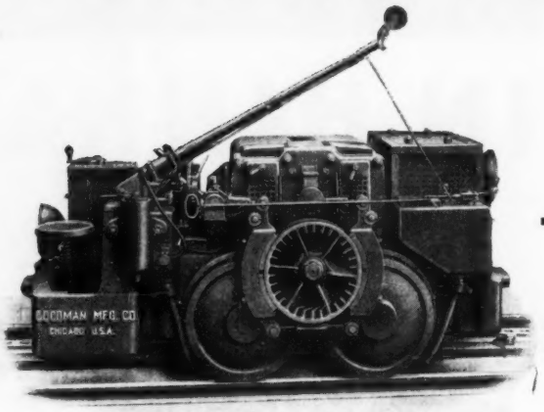
14—GATHERING LOCOMOTIVES—14

11—HAULAGE LOCOMOTIVES—11

PROGRESS

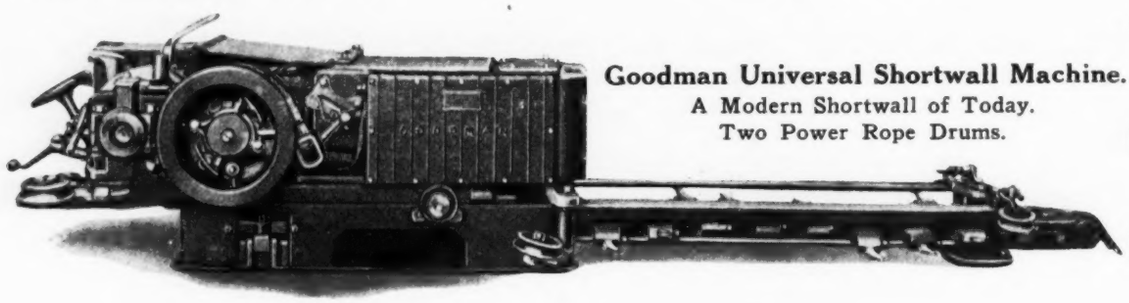


Good Old Breast Machine.
Doubled the Tonnage in Its Day



Good Old Rack Rail Locomotive.
A Giant Puller in Its Day

PROGRESS



Goodman Universal Shortwall Machine.
A Modern Shortwall of Today.
Two Power Rope Drums.

Modern 13-Ton Main Haulage Locomotive.
Trolley Type.

Goodman Builds a Complete Line of Coal Mining Equipment
CUTTERS · LOADERS · LOCOMOTIVES

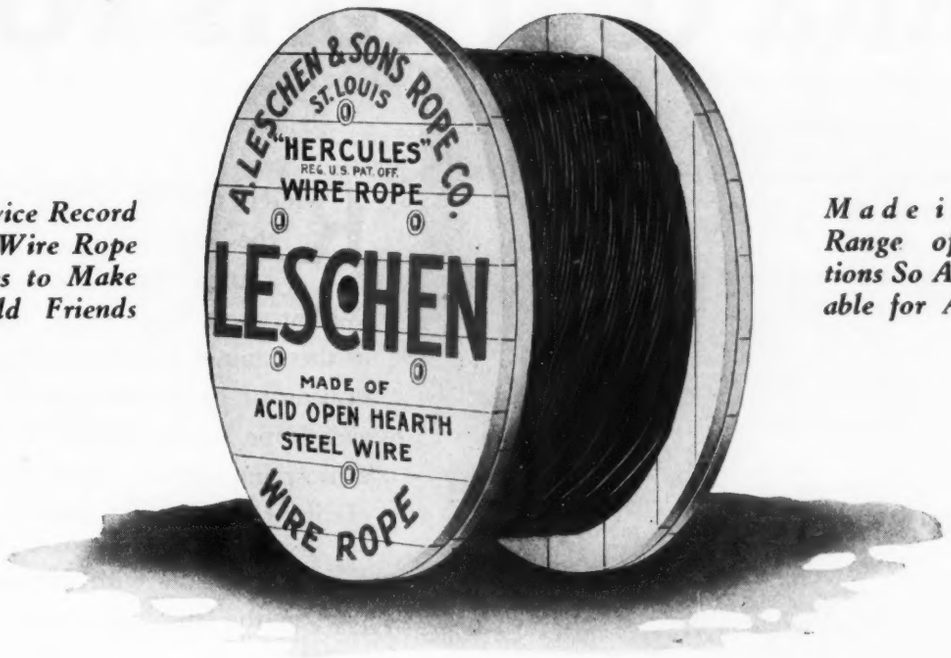
GOODMAN MANUFACTURING COMPANY

HALSTED ST. at 48TH.
CHICAGO - - - ILL.

Locomotives - Loaders - Coal Cutters

PITTSBURGH-WILKES-BARRE-HUNTINGTON-BIRMINGHAM-ST LOUIS-DENVER-LOS ANGELES (79)

The Service Record of This Wire Rope Continues to Make and Hold Friends



Made in a Wide Range of Constructions So As to Be Suitable for All Purposes

The First Cost of Wire Rope Doesn't Mean Economy—It's What the Rope Can Do that Counts!

Real wire rope economy is not based on low first cost, for it is the tonnage or yardage handled for each dollar of a rope's cost that gives the answer; moreover, the kind of wire rope that requires frequent replacement not only slows down the work, but it often becomes an unlimited liability.

"HERCULES" (Red-Strand) Wire Rope is economical because of its day after day dependability. There are many reasons why this is so, and we are always glad to give full particulars, which involve materials, methods, manufacturing equipment and experience.

Another important factor in the long-run economy of "HERCULES" (Red-Strand) Wire Rope is that it is furnished in a wide range of constructions; there is always a right type of "HERCULES" rope for every condition—and our experienced salesmen and engineers are at the service of everyone who wants to save money on his wire rope purchases.

Made Only by **A. LESCHEN & SONS ROPE CO.** Established 1857

5909 KENNERLY AVENUE

ST. LOUIS, MO.

New York - - - - - 90 West Street
Chicago - - 810 W. Washington Blvd.
Denver - - - - - 1554 Wazee Street
San Francisco - - - 520 Fourth Street

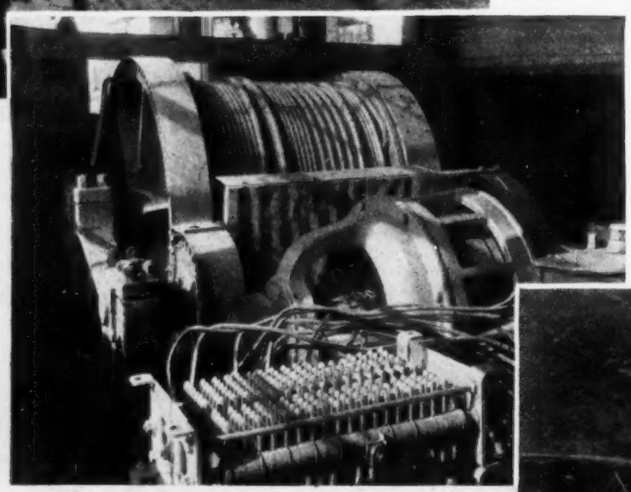
Hanna Coal Co. is 100%

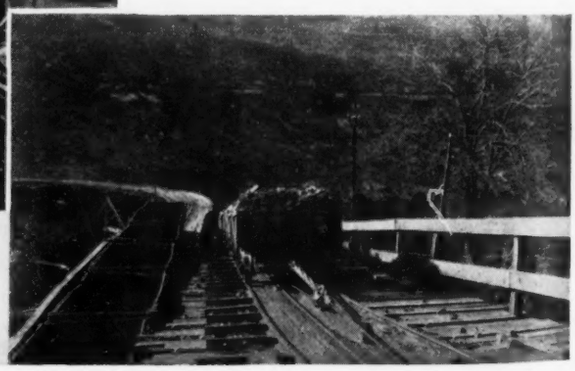
RIGHT NOW, while you have read the interesting facts about the Hanna Mines, please remember that Williamsport Wire Rope, used exclusively in these mines and the Telfax Tape identification of grade throughout the length of each rope, means SAFETY, and safety is a most important consideration in the operation of the Hanna Mines.

Experimentation with human life has no part in the makeup of this series of vast operations.

Many large operators *stress* Safety, but—they use Wire Rope in most dangerous operations, the grade and Tensile Strength of which they have no sure means of checking. Some operate on the theory that any wire rope of a required dimension is okay.

A most critical theory. Why? because there's a difference of over 28 tons in tensile strength between the two outside grades of a one inch wire rope — and *You* cannot easily tell the differ-





Williamsport

"Williamsport" equipped

ence by *looking* at them. You need absolute proof! Not the mark on a tag or reel, but by the Telfax Tape System of grade marking found only in Williamsport Wire Rope. Why talk safety and take such chances?

In this particular instance we pay tribute to Mr. Joe Clay whose interest in seeing that ropes of proper strength and construction throughout these model mines is worthy of emulating wherever Wire Rope is used.

Let us quote you on your next requirements.

WILLIAMSPORT WIRE ROPE CO.
Main Office & Works:
WILLIAMSPORT,
Penna.

•

Branch Sales Offices:
122 So. Michigan Ave.,
CHICAGO, ILL.
and other prominent
shipping points

JOE CLAY
VICE PRES. AND MANAGER
PUBLIC SERVICE SUPPLY CO. INC.

Wire Rope Co.

A MILE *of* MACHINERY

and no need of an oil can or a grease gun!

NEW DEPARTURE
N-D-SEAL BEARING FOR
CONVEYOR ROLLS

...Lubricated for Life!

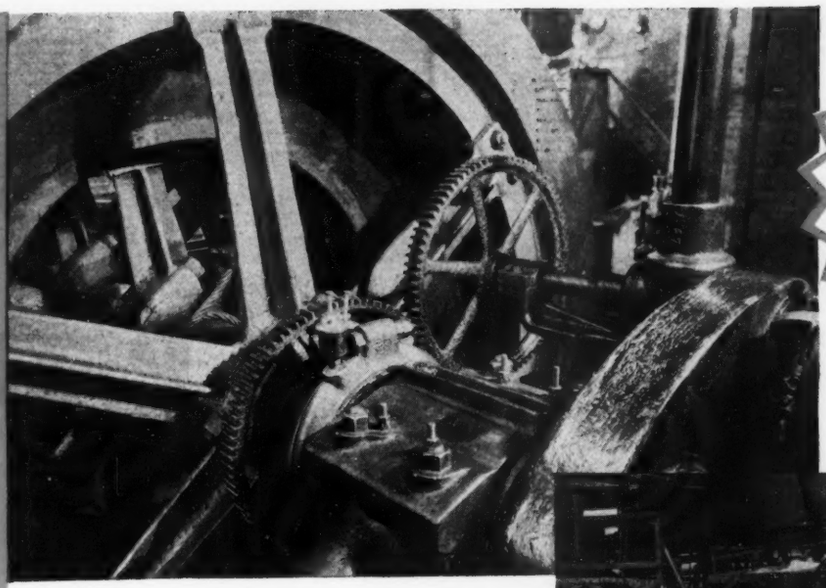
● Impossible? Quite the contrary—because New Departure has developed a ball bearing for conveyors like this, which is self-sealed — *lubricated for life!* It is entirely service-free.

It marks the beginning of a new era in bearing and conveyor design. Details of its many advantages are interestingly described in a new book entitled "Lubricated for Life," which will be mailed on request. This is only one of many revolutionary bearing types announced by New Departure in a single year. It will pay you to bring your problems to leaders of thought and practice in the bearing field.

NEW DEPARTURE BALL BEARINGS

The New Departure Manufacturing Co., Bristol, Connecticut. Engineering branches at Detroit, Chicago, San Francisco, and London, England.

NOTHING ROLLS LIKE A BALL



(*Above*) These hoisting drum gears and bearings need tough lubricants to protect them in the continuous hard service they must perform. Gulf supplies just the right type of lubricants to avoid wear and operating trouble

NOTE

The booklet shown below will be sent to all coal mine operators and executives who mail the coupon or send request on their letterheads.

(*Below*) Gulf's mine car lubricants have made outstanding savings in many mines including this one

LESS OVERHAULING *with* GULF LUBRICANTS

(*Below*) This is one of the cutting machines concerning which the manager of the Gibralter Coal Company definitely states that less overhauling is required with Gulf lubricants

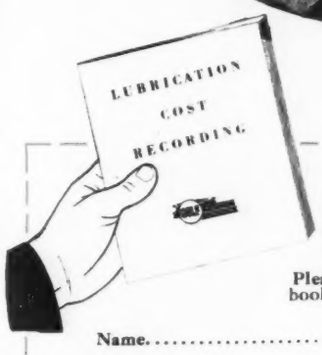
"Our machines require less frequent overhauling and all equipment operates better with Gulf Lubricants"...

says Mr. J. A. Smith, Gen'l Mgr. Gibralter Coal Co.

HERE is another outstanding example of a mine which has made *definite* savings with Gulf lubricants! This mine manager is just one of many who are finding that Gulf lubricants and engineering service cut operating costs for coal mine equipment.

The real job that lubrication has to perform in coal mines is to *reduce maintenance and repair costs.* To assist mine operators in measuring the efficiency of their lubrication by a convenient yardstick we are offering the booklet shown below.

This booklet will help you establish the *real* value of the lubricants you are using.



This booklet will help you reduce operating costs. Your copy is ready.

C.A. 12

GULF REFINING COMPANY,
3800 Gulf Building, Pittsburgh, Pa.

Please send me without obligation, the booklet "Lubrication Cost Recording."

Name.....Title.....

Company.....

Address.....

GULF REFINING CO. Pittsburgh, Pa.

District Sales Offices:

Boston, New York, Philadelphia, Atlanta, Houston, New Orleans, Louisville, Toledo, Pittsburgh

GULF INDUSTRIAL LUBRICATION

WHEA

ELECTRIC CAP LA

predominate at "HANNA COAL"

Of the six mines operated by the Hanna Coal Company at St. Clairsville, Ohio, four are 100% equipped with Wheat Electric Cap Lamps.

Putting it another way, approximately 82% of all the Electric Cap Lamps in use are Wheats. So we are stating the case mildly when we say that Wheat Electric Cap Lamps predominate at "Hanna Coal."

Naturally, the majority of Wheat Lamps now in service are of an older type than the new "Model Q" here illustrated, but Model Q lamps are being introduced as rapidly as necessary to replace the older types—about 200 being now in service.

This new Model Q Wheat Lamp is just a smaller size of our popular Model W—giving close to the same amount of light for the shorter work day with much less weight.

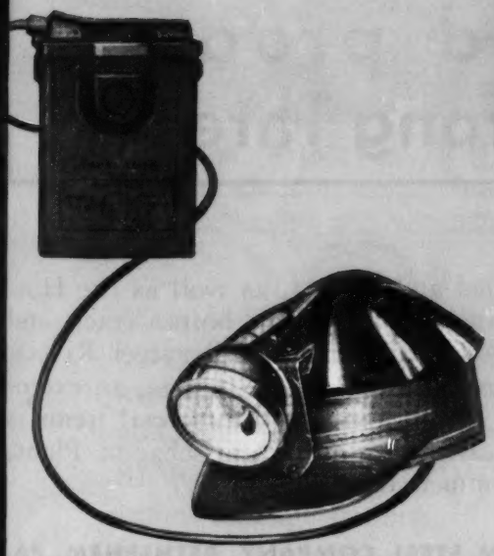
The battery is so small that it can be completely carried in a coat pocket. Try it—the picture is actual size—or, better still, ask for one of our representatives to come and demonstrate it.

The Portable Lamp & Equipment Co., 405 Penn Avenue, Pittsburgh, Pa., Distributors in the Bituminous Coal Fields for the Koehler Manufacturing Co., Manufacturers of Wheat Lamps, are prepared to go over your Lighting Problems with you. Portable Lamp & Equipment Co. is also distributor for the well known Cool Cap illustrated herewith.

AT

AMPS

ACTUAL SIZE



Showing headpiece mounted on COOL CAP

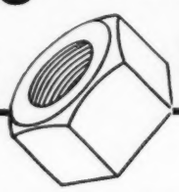
KOEHLER MANUFACTURING CO., *Marlboro, Mass.*

Distributors:

Bituminous Coal Fields:
PORTABLE LAMP & EQUIPMENT COMPANY
405 Penn. Avenue, Pittsburgh, Pennsylvania

Penn. Anthracite Coal Fields:
G. A. LUCKENBACH, 1634 Jeff Avenue, Scranton, Penn.

Only Forging could produce these tough, strong Threads



THE BETHLEHEM Hot-Forged Nut has threads that stand up under severe wrenching stresses, shock and fatigue, in a way impossible to a nut made by ordinary methods. Only forging could produce a nut so able to take punishment. Only forging could bring the dense grain structure, the strong threads that the Hot-Forged Nut possesses. It's practically made to order for the heavy-duty task.

Bethlehem Hot-Forged Nuts are the logical ones for service in pumps and valves, in high-pressure, high-temperature equipment. Use them, too, with heat-treated track-bolts, and in railroad and mine equipment—in fact, wherever threads must be depended upon to stand up.

Bethlehem Hot-Forged Nuts are made by men who know nut manufacture from A to Z, at our Lebanon, Pa., Plant. Among Lebanon Plant products are: All kinds of nuts, including cold-punched and treated, as well as the Hot-Forged. Machine and track bolts. Track and mine spikes, made from new-billet steel. Rivets, turnbuckles, etc. For service to you, an extensive range of all standard commercial items is regularly carried in stock at Lebanon Plant, ready for immediate shipment.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

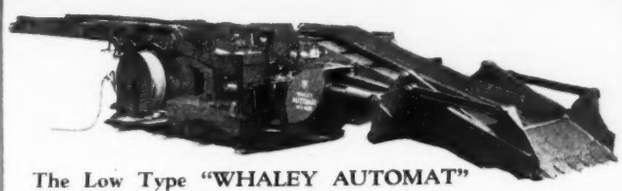
District Offices: Atlanta, Baltimore, Boston, Bridgeport, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Houston, Indianapolis, Milwaukee, New York, Philadelphia, Pittsburgh, St. Louis, St. Paul, Washington, Wilkes-Barre, York. *Pacific Coast Distributor:* Pacific Coast Steel Corporation, San Francisco, Seattle, Los Angeles, Portland and Honolulu. *Export Distributor:* Bethlehem Steel Export Corporation, New York.

BETHLEHEM BOLTS AND NUTS

"WHALEY AUTOMAT" COAL LOADERS

help cut costs of "HANNA COAL"..
.. and LOAD ALL COAL
produced in their
Mechanized Mine—

In No. 9 Mine—Hanna Coal Co.



The Low Type "WHALEY AUTOMAT"

Parallel-lift rear conveyor; height overall 44 in.; width 5 ft. 8 in.; reach of shovel 11 ft. to each side or 22 ft. total width; capacity 7 tons per min.; average loading rate 2 to 3 tons per min.; track mounted; single motored; weight approx. 17,500 lbs.

FOR over four years the Hanna Coal Company has been using "WHALEY AUTOMAT" Coal Loading Machines, Double Shift for years and now Triple Shift. Six are used in No. 9 Mine, which operates 6 days a week, three 7 hr. shifts per day. Three "WHALEY AUTOMATS" are used in other Mines of the Hanna Coal Company for entry driving and clean up work.

SINGLE SHIFT, DOUBLE SHIFT, or TRIPLE SHIFT, steady, maximum tonnage is obtained by the "WHALEY AUTOMAT."

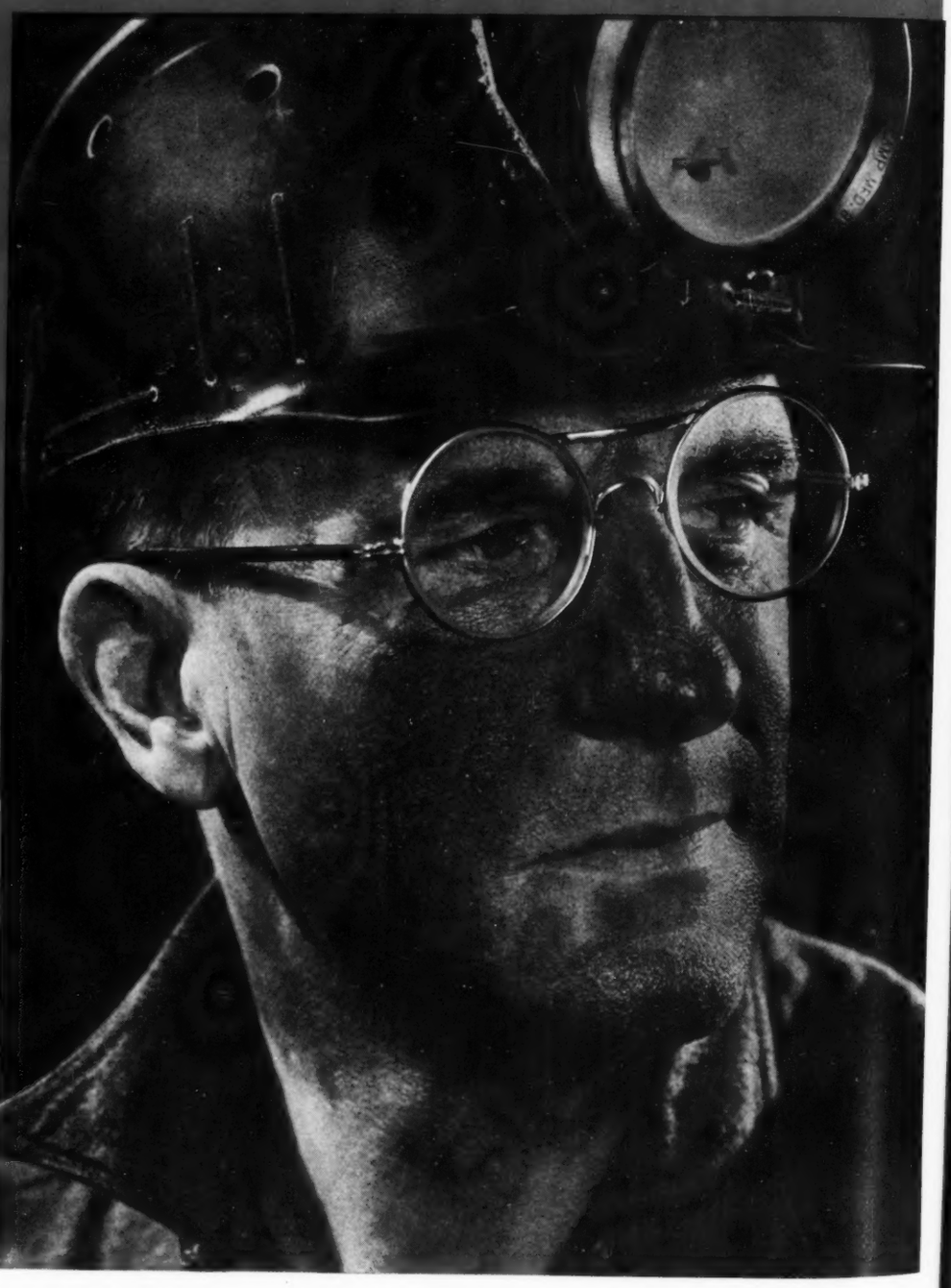
The "WHALEY AUTOMAT" requires a minimum of track work and a minimum crew—no jacks, ropes or other extraneous devices are used. The machine can be used in close timbering.

The "WHALEY AUTOMAT" has a true shovel motion, rapid, easy, effective and smooth—no breakage of coal (degradation) by the machine. The machine loads coal limited in size only by roof clearance.

MYERS WHALEY CO., INC.

Knoxville . . . Tennessee

Goggles on your



American Optical Company safety goggles are distributed to the mining industry by Mine Safety Appliances Company of Pittsburgh, who maintain trained representatives in every important mining field.

MINE SAFETY APPLIANCES CO. PITTSBURGH PA

AO spectacle-type goggles provide *effective* protection for breaker employees and underground workers. Earpieces and bridges are sturdy—yet adjustable for comfortable fitting. Super Armorplate lenses provide greater resistance to impact than any other standard lens.

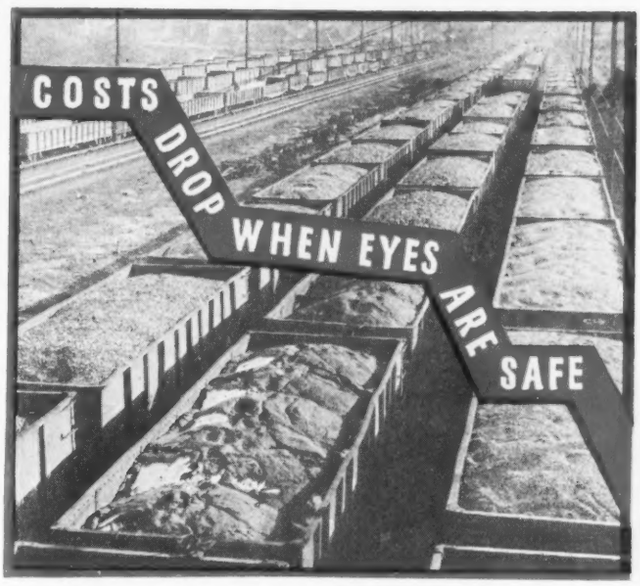
workers' Eyes *reduce your cost per ton*

EYES ARE AT A PREMIUM and the premium is *high.*

By preventing eye accidents, goggles save coal operators 1, 2 and 3 cents a ton in compensation, lost time, hospital and medical expenses. A goggle program and safety campaign saved one company $30,000 a year. During the fifth year of his campaign another operator has eliminated lost-time eye accidents completely. Another put goggles on all underground workers and at the end of two years had reduced all eye injuries 95%.

Even minor accidents to eyes cost far more than the goggles that prevent them. In many districts, goggles actually cost less than the insurance credits they earn. In *any* district the cost of a single eye accident would put AO goggles on a thousand men.

American Optical Company, represented in the coal mining industry by the Mine Safety Appliances Company, offers a wide selection of goggles for every mine eye hazard . . . a service that helps you to obtain the type of goggles best suited to the needs of each man . . . and every cooperation in making your safety program more effective and profitable.



Cost records show savings of one, two and three cents per ton when workers are given real eye protection—AO goggles, backed by effective eye-safety programs.

American Optical Company

REPRESENTED IN THE MINING INDUSTRY BY MINE SAFETY APPLIANCES COMPANY

1349

"U. S." BELTING SERVES THE PENN

in one of the biggest, most up-to-date developed for

1

2

3

4

The United States Rubber Company, working in close cooperation with the Jeffrey Manufacturing Company, has installed over 15,000 feet of conveyor belting throughout the underground workings of the Harry Taylor and Rush Brook mines, properties of the Penn Anthracite Company. The coal is then transported to the Van Storch Central Breaker, where "U. S." has some additional interesting installations, described on the following pages.

The conveyor belt system operates as follows: Extending into the actual workings are a series of "U. S." feeder belts in the Harry Taylor mine and in the Rush Brook mine. Subsidiary belts feed coal to a main slope belt (750 feet center to center) which carries it to the surface where it discharges the entire output on to a Descending Belt Conveyor. This latter belt, 30 inches wide and 3700 feet long, carries the coal down the mountain side and delivers it to railroad cars at a loading platform.

All belts are reversible and, in addition to conveying coal and waste out of the mine, are utilized to transport supplies (except explosives) to the working areas.

Because of the careful planning and expert engineering back of this unusual installation, the whole system operates with the greatest satisfaction.

• • •

Built of the highest possible grade of materials and featuring the famous "U. S." balanced construction, "U. S." Conveyor Belts are unrivalled throughout industry for record endurance and economical performance.

Turn your belting problems over to "U. S." and let "U. S." show you the way to better performance and longer belt life. The nearest "U. S." office will put an expert at your service, without obligation, of course. Write or call today.

UNITED STATES RUBBER COMPANY · US · TRADE MARK

United States

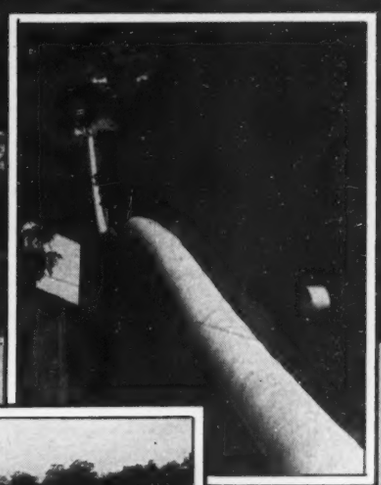
1790 BROADWAY

ANTHRACITE MINING COMPANY

mechanized underground systems ever

Coal Mining and . . . (see following page)

5



6

7

1 Here is shown the delivery end of a 26-inch descending conveyor belt—2160 feet long—in which the pitch varies from 15 to 19 degrees.

2 This 26-inch "U. S." belt—1800 feet long, collects coal from various chambers and delivers to the slope belt.

3 Another 26-inch feeder belt—1560 feet long—delivering to slope belt.

4 The "U. S." 30-inch slope belt—1500 feet long—operated by 40 hp. motor and receiving from the descending conveyor.

5 Upper end of slope belt delivering to descending surface conveyor belt to railroad tracks.

6 The descending belt conveyor carries anthracite from slope conveyor to railroad cars. This 30-inch "U. S." belt is 3700 feet long and transports the entire output of the mine, consisting of coal sizes from 20" x 30" to fines.

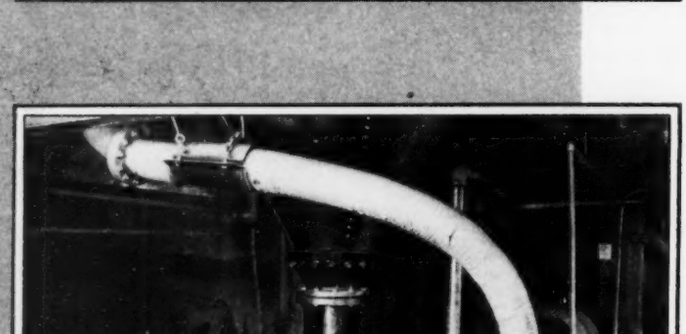
7 The end of 3700-foot 30-inch "U. S." belt delivering coal to cars for shipment to the Van Storch Central Breaker.

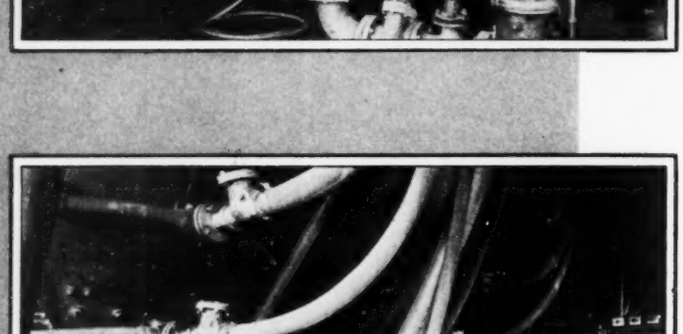
NRA CODE

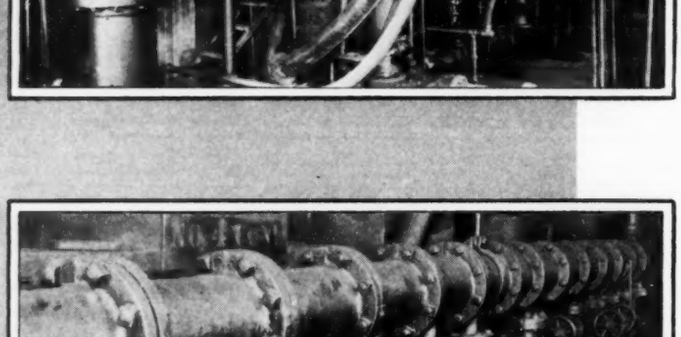
Rubber Company

NEW YORK CITY

"U.S." FLEXIBLE RUBBER PIPE, "U.S." RUBBER *are rendering outstanding service at the Anthracite coal is*







The system used at the Von Storch Central Breaker to remove rock and slate is the Chance System, installed by the H. M. Chance Company of Philadelphia.

Throughout the installation, wherever the abrasive mixture of sand and water must be handled, "U. S." Pilot Flexible Rubber Pipe, "U. S." Rubber Lined Fittings and "U.S." 193 Packing are in service.

It is a matter of record that the "U. S." Pilot Flexible Rubber Pipe, "U. S." Rubber Manifold Pipe or Cast Iron Rubber Lined Fittings are outlasting, from four to eight times, the metal pipe formerly used. In fact, the original "U. S." Pilot lines in this plant have now been in service over four years and the manifold pipe has served three years—with *no* sign of wear. Other advantages are the ease of installation, the elimination of leaking and bursting pipe, and the marked reduction of maintenance.

If you have an abrasive handling problem that is running into excessive costs, put it up to the "U. S." engineering staff. No obligation, of course. Simply get in touch with the nearest "U. S." office, or U. S. Rubber Company, 1790 Broadway, New York, N. Y.

• • •

1 Von Storch Pumphouse. Water is pumped to breaker at the rate of 6,600 gallons per minute by the pumps shown. "U. S." 193 packing is used on the pump shafts.

2 One six-inch "U. S." flexible rubber pipe line discharging to two fine coal cones, also shown in photograph No. 3. Note—the "U. S." water hose for keeping room clean.

UNITED STATES RUBBER COMPANY · US · TRADE MARK

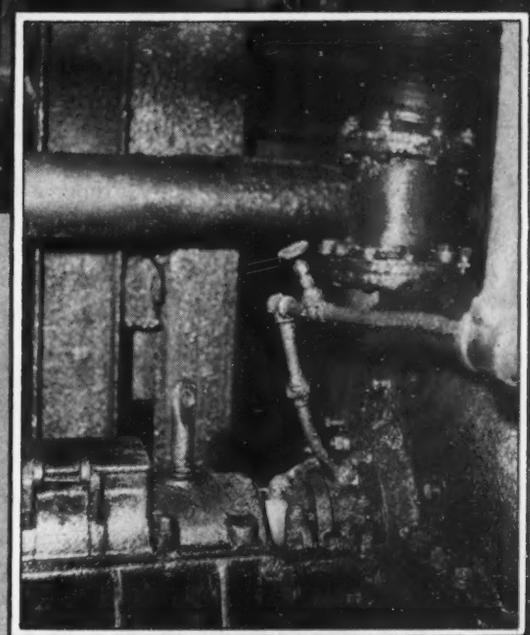
United States

1790 BROADWAY

LINED FITTINGS and "U. S." PACKING

Von Storch Central Breaker where Penn prepared for market

7



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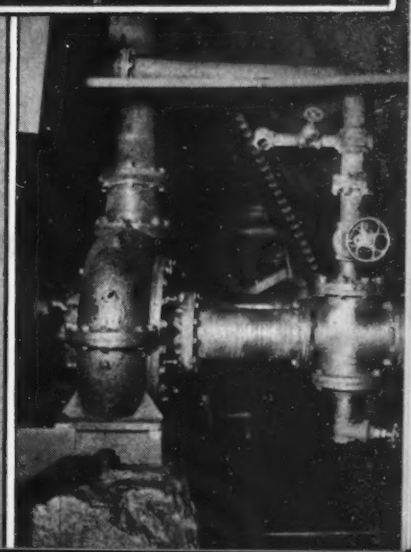


6

3 A six-inch "U. S." flexible rubber pipe line shown in No. 2, and "U. S." manifold pipe lines conducting water to cone manifolds, which are also made of "U S." manifold pipe.

4 This illustrates how a sand pump receives sand and water from the sand cone. It travels by way of a "U. S." cast iron, rubber-lined and rubber-covered elbow inside of cone through a "U. S." flexible pipe sleeve into the elbow shown, which is "U. S." cast iron, rubber-lined; through rubber-lined valve and cross, and "U. S." flexible pipe, to intake of pump. Also shown is how water is discharged from pump through a 10-inch x 8-inch "U. S." flexible pipe reducer and into an 8-inch "U. S." flexible pipe line which conducts it to the cone on floor above. There are four pumps as shown, each discharging into an 8-inch "U. S." flexible pipe line 55 feet long to the four cones cleaning domestic coal on one of the upper floors.

5 "U. S." No. 193 packing protects the shaft in this stuffing box. "U. S." No. 193 outlasted anything ever used before.

6 Showing one of the sand pumps, and "U. S." cast iron, rubber-lined elbow, and "U. S." flexible pipe which carries sand and water to the intake of pump.

7 Delivery end of the breaker where finished coal is shipped to market. "U. S." conveyor belt facilitates loading and prevents breakage of the coal. By the use of "U. S." belt, coal can be loaded directly into the cars from the shaker screens.

Rubber Company

NEW YORK CITY

6735

tons of clean, uniform coal per hour

KOPPERS-RHEOLAVEUR COAL-CLEANING PLANTS

The Hudson Coal Co., Scranton, Pa.	30
Glen Alden Coal Co., Nanticoke, Pa.	325
Glen Alden Coal Co., Nanticoke, Pa.	325
Glen Alden Coal Co., Nanticoke, Pa.	125
Glen Alden Coal Co., Nanticoke, Pa.	25
Lehigh Valley Coal Co., Hazleton, Pa.	125
Lehigh Valley Coal Co., Wilkes-Barre, Pa.	350
The American Smelting & Refining Co., Cokedale, Colo.	120
Shamokin Coal Co., Shamokin, Pa.	150
Pacific Coast Coal Co., Seattle, Wash.	150
Great Valley Anthracite Corp., McCoy, Va.	125
Pittsburgh Coal Co., Champion, Pa.	650
Pittsburgh Coal Co., West Newton, Pa.	450
Pittsburgh Coal Co., Van Meter, Pa.	400
Pittsburgh Coal Co., Negley, Ohio	225
American Rolling Mill Co., Nellis, W. Va.	200
Buckeye Coal Co., Nemacolin, Pa.	650
Houston Collieries Co., Kimball, W. Va.	225
Houston Collieries Co., Keystone, W. Va.	300
C. C. B. Smokeless Coal Co., Glen White, W. Va.	235
Pardee Bros. & Co., Inc., Lattimer Mines, Pa.	100
Carnegie Steel Co., Clairton, Pa.	725
Midland Electric Coal Corp., Atkinson, Ill.	15
Indian Head Anthracite, Inc., Tremont, Pa.	110
United Electric Coal Companies, DuQuoin, Ill.	600

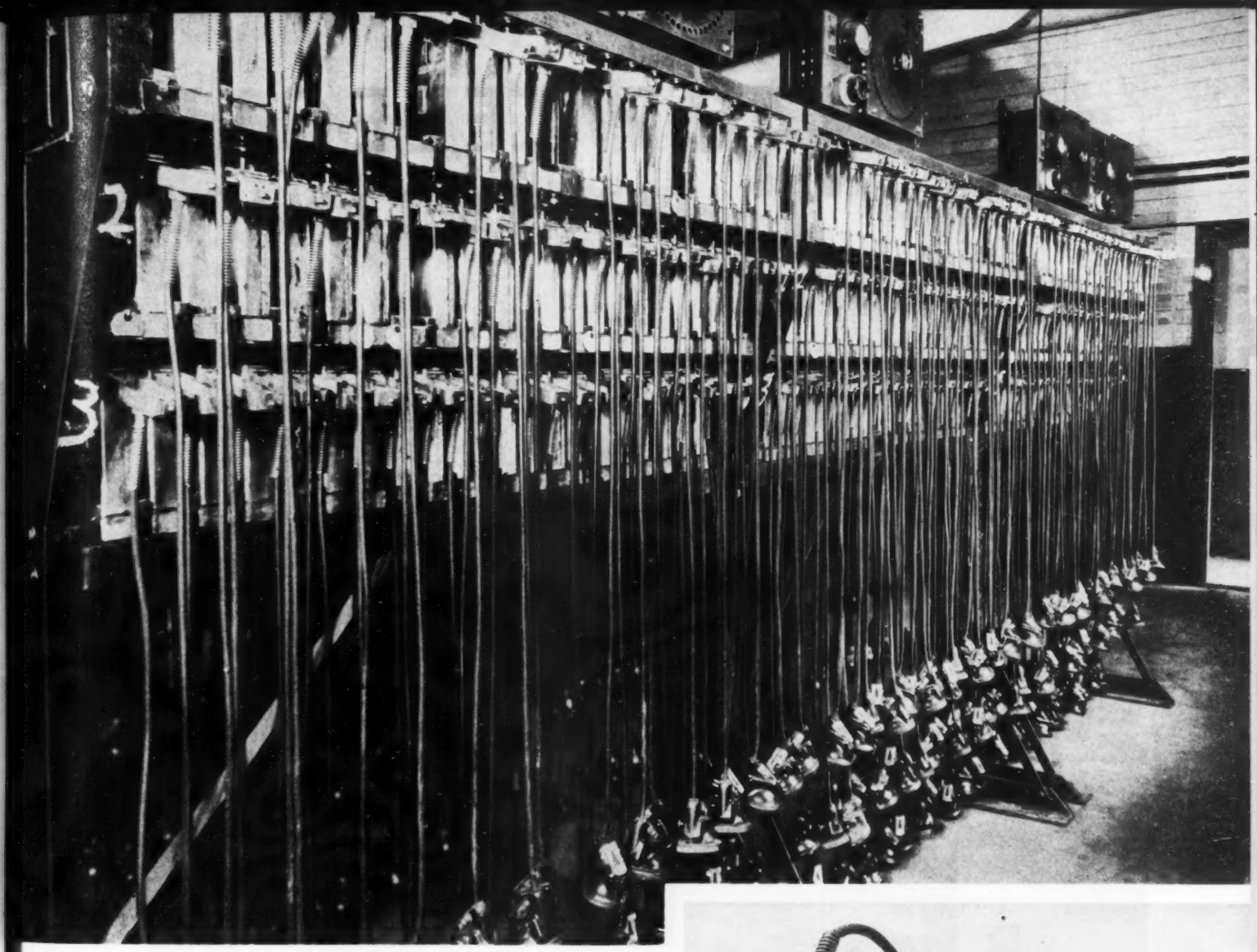
These prominent producers selected Koppers-Rheo Cleaning for simplicity, effectiveness and low costs. More important than any other consideration, they are meeting the modern demand for *high quality coal* —constantly clean and uniform in size. Why not let Koppers-Rheo engineers investigate your problem?

KOPPERS-RHEOLAVEUR COMPANY

KOPPERS BUILDING, PITTSBURGH, PENNSYLVANIA

The Rhéolaveur CURRENT WASHER

Reg. U. S. Pat. Office



At Hanna's Willow Grove Mine...

it's EDISON ELECTRIC CAP LAMPS

We're glad to join the coal-mining world in saluting the Hanna Coal Company. We're proud to have contributed to the efficiency of their Willow Grove operation through the installation of 425 Edison Electric Safety Cap Lamps . . . the most popular cap lamps made . . . the source of the whitest, brightest, most reliable working light obtainable.

The better your men can see, the better *(and safer)* your men! You can install Edison Cap Lamps without a cent of initial investment. Write for details of our rental plan of purchase, and let us arrange an underground demonstration.

MINE SAFETY APPLIANCES CO.

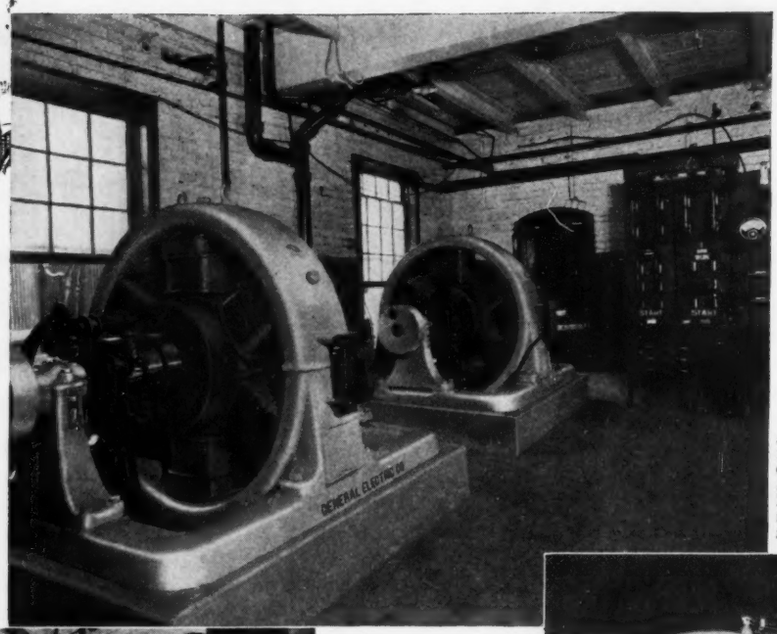
Braddock, Thomas and Meade Streets, Pittsburgh, Pa.
District Representatives in Principal Cities

NRA CODE 1934

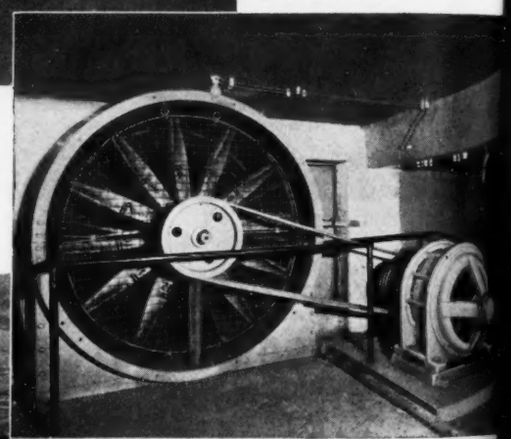
For efficiency and safety

EDISON ELECTRIC CAP LAMPS *and* **M·S·A SKULLGARDS**

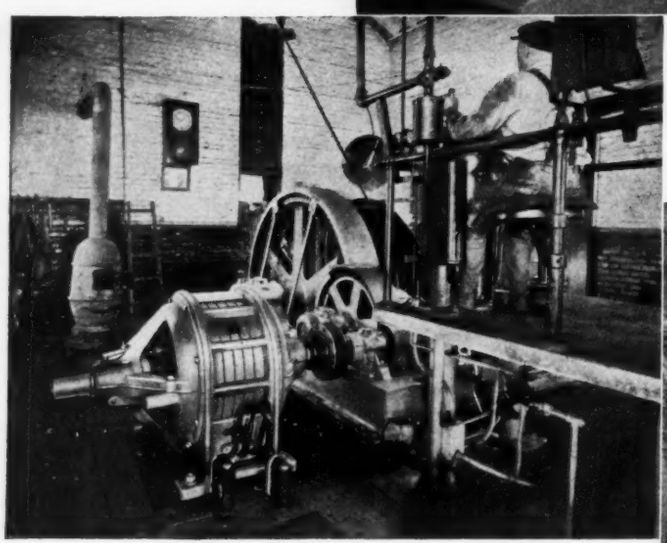
HOW ELECTRIC
HANNA COMPANY



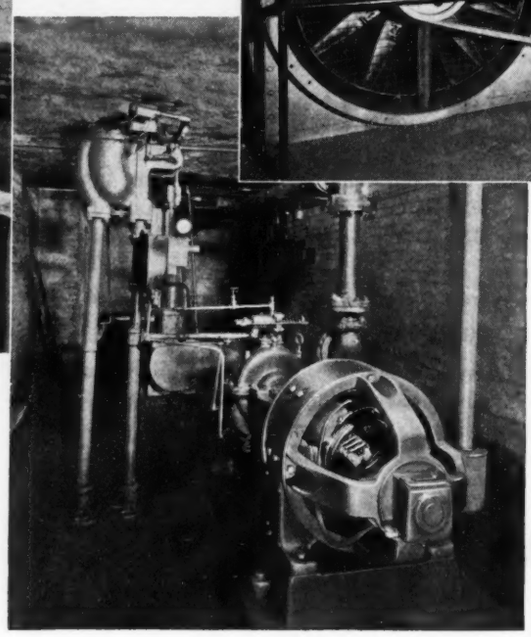
At Willow Grove, two G-E 200-kw. rotary converters operate in the outside substation. Complete General Electric substation equipment is available for mining installations



This modern ventilating equipment at Hanna's Piney Fork mine is powered by a dependable 50-hp. G-E induction motor. Reliable apparatus is of primary importance in such installations



At Hanna No. 6, a shaft mine, this sturdy 150-hp. G-E motor, with magnetic control, operates a double-geared hoist. This is one of hundreds of General Electric equipped mine hoists in the United States



This 40-hp. G-E d-c., Type CD motor drives a two-stage, full-automatic centrifugal pump in underground drainage service at the No. 6 mine

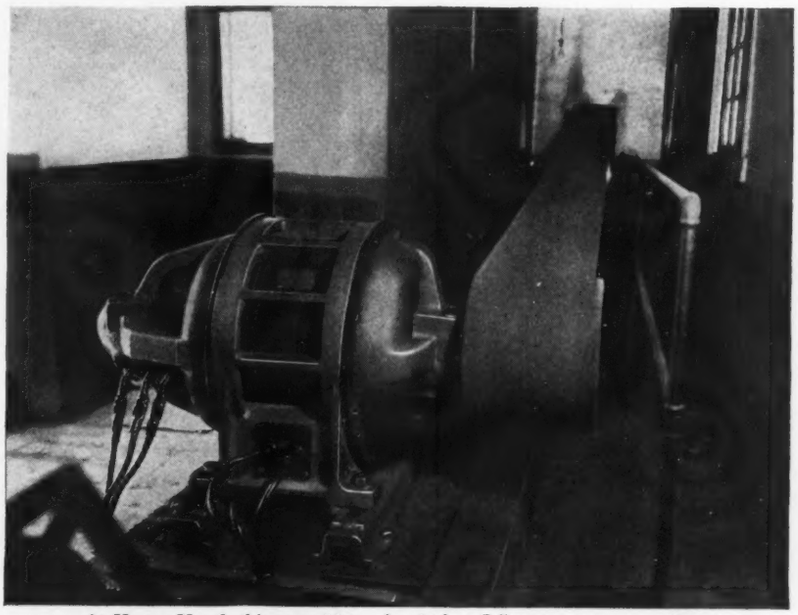
GE

GENERAL

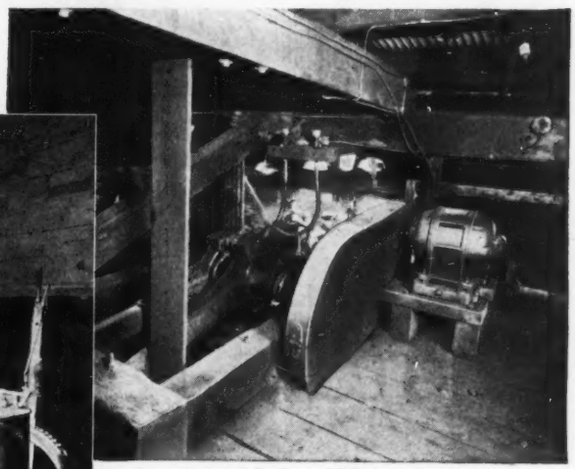
MODERNIZATION *helps increase* PROFITS

THE Hanna Coal Company, one of the largest and most progressive coal-mine operators in Ohio, is a leading exponent of modern, mechanized mining. The six Hanna mines near St. Clairsville, Ohio, are equipped with the latest design of dependable electric equipment for operating hoists, pumps, ventilating systems, compressors, and conveyors. General Electric equipment was selected for many of these important jobs. The use of such dependable apparatus is constantly adding to profits through freedom from interruptions, elimination of expensive repairs, and increased rate of production.

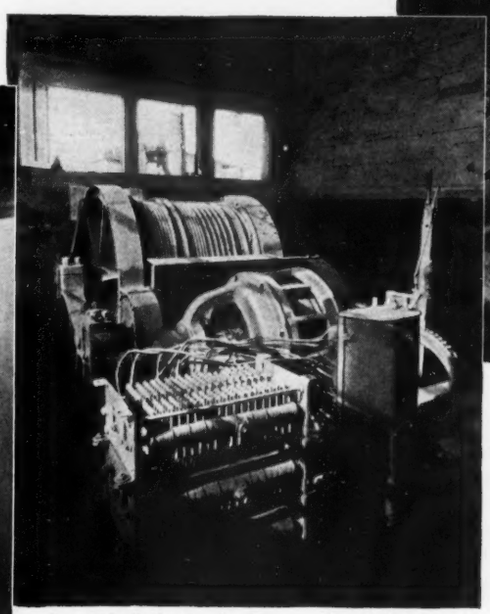
You, too, can profit by equipping your mine with the RIGHT motors, control, and cable for your jobs. General Electric can meet every need with dependable equipment, progressive engineering, and prompt service. Conveniently located service shops are available to assist you in emergencies. G-E sales engineers are always ready to help you find the best solution of your problems of electric equipment for the coal mine. General Electric, Schenectady, N. Y.



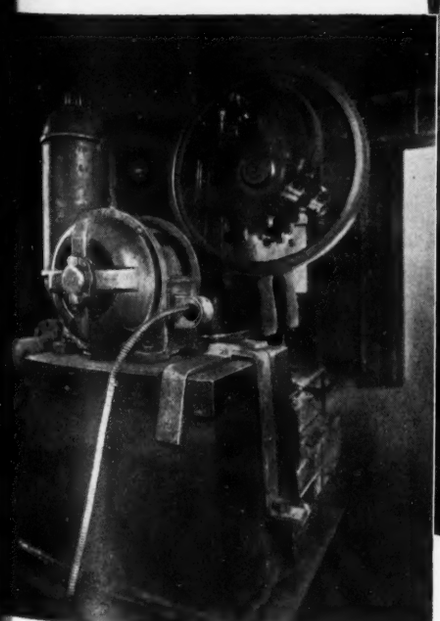
At Hanna No. 6, this new 500 series 50-hp. G-E motor operates a large ventilating fan through a leather-belt drive. Dependable equipment is essential in safeguarding human life



One of the G-E Type FTR motors operating a cleaning shaker in Hanna's No. 9 mine at Fairpoint. Dependable small G-E motors play important parts in driving accessory equipment throughout the Hanna properties



A supply hoist in the No. 6 mine at Lafferty, driven by a 50-hp. G-E motor. The husky end-shields and bearings on this new line of motors give assurance against breakdown on geared machinery



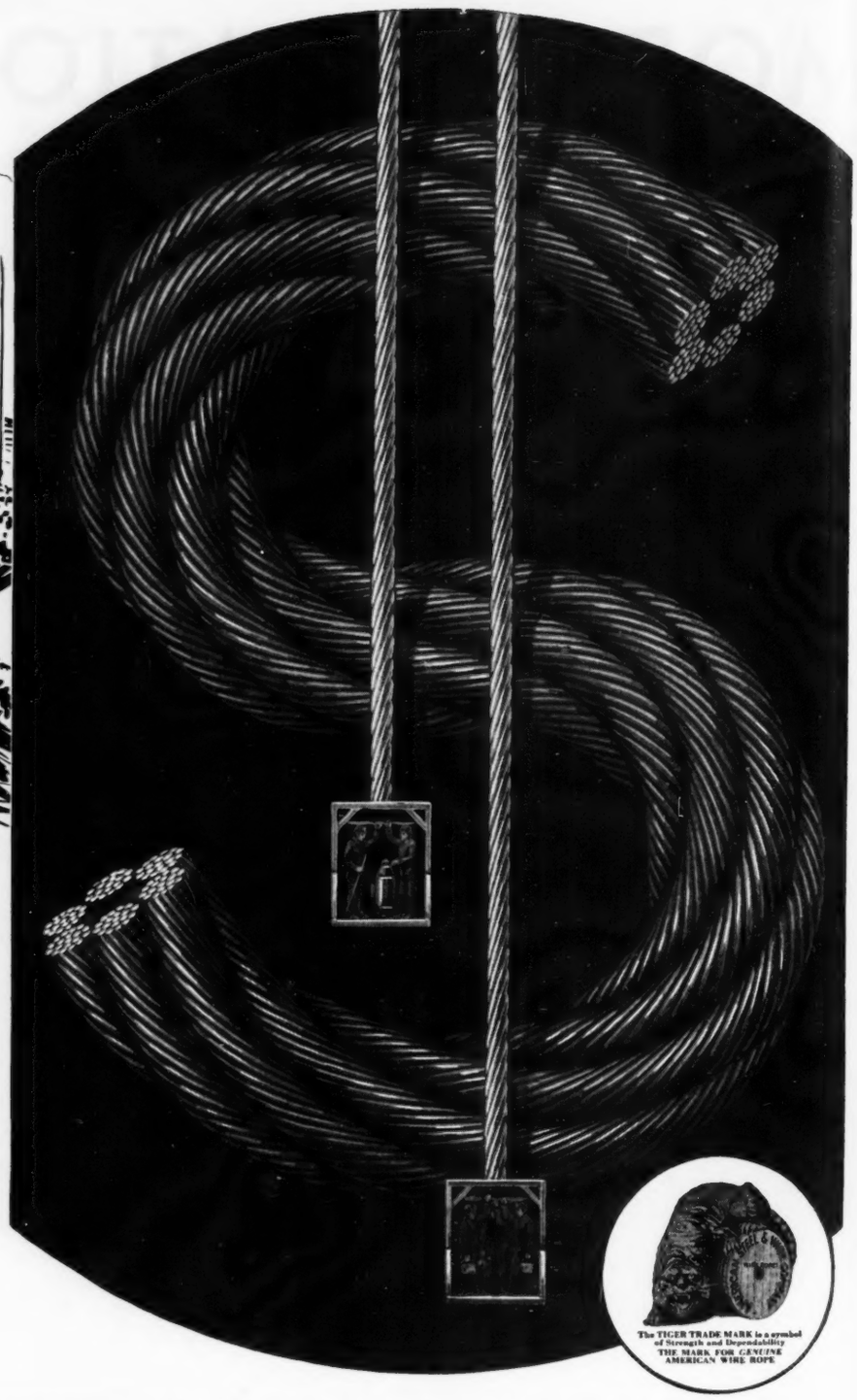
A 15-hp. G-E ball-bearing induction motor driving a vertical triplex pump, operating under continuous service, supplying water to the refuse dump

020-103

E L E C T R I C

Judged

BY THE DOLLAR SIGN



WE have many customers who keep service and cost records on wire rope. We are proud to serve these companies—our best testimonials come from them. Equally as complimentary is the action of other mine operators who have tried our products because of their established reputation—and have continued to specify American Steel & Wire Company Wire Rope year after year.

Our experienced engineers are ready to help you select precisely the right type and grade of wire rope for hoists, mining machines, scraper loaders, car hauls, shovels, rope-and-button conveyors, aerial tramways or any other mining requirement. In every instance proper wire rope selection means more dependable service and greater value per dollar invested.

1831 MORE THAN 100 YEARS OF PROGRESS IN WIRE MAKING **1934**

AMERICAN STEEL & WIRE COMPANY

208 South La Salle Street, Chicago
94 Grove Street, Worcester

SUBSIDIARY OF UNITED STATES STEEL CORPORATION

Empire State Bldg., New York
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AND ALL PRINCIPAL CITIES

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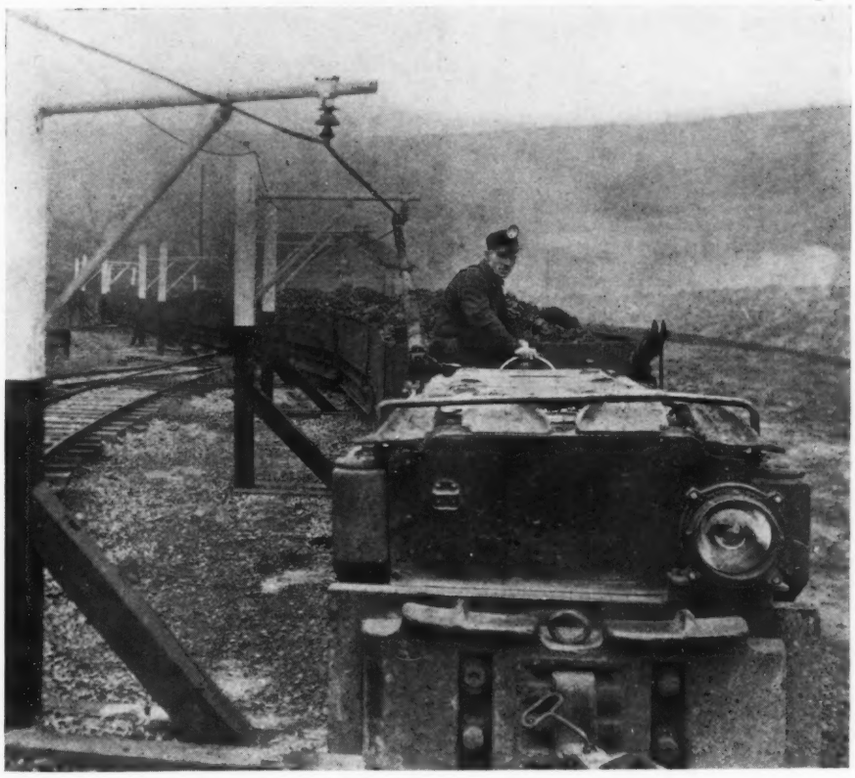
Still another Model Mine keeps costs down

by using . . .

"TOOL STEEL" GEARS AND PINIONS



Locomotive at the HANNA COAL COMPANY Coal Age 1934 Model Mine. This company uses "Tool Steel" gears and pinions regularly and in large quantities. They report excellent results.

In the last 13 years, of the Model Mines featured by Coal Age **73%** were "Tool Steel" gear and pinion users.

It's the same story each time—the big efficient mines, on their toes for quality and reduced costs use "TOOL STEEL" gearing.

THE TOOL STEEL GEAR & PINION COMPANY
CINCINNATI, OHIO

The JOY-M & C Samson Cutter

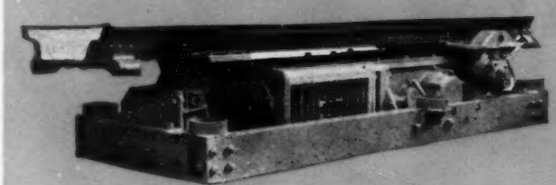
Joy

MECHANIZATION IS MODEL MINING

The JOY-M & C Face Belt Conveyor

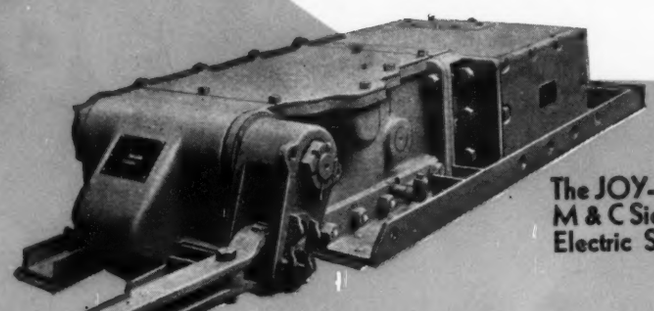
Cross Section Trough Conveyor

The JOY-M & C Trough Conveyor



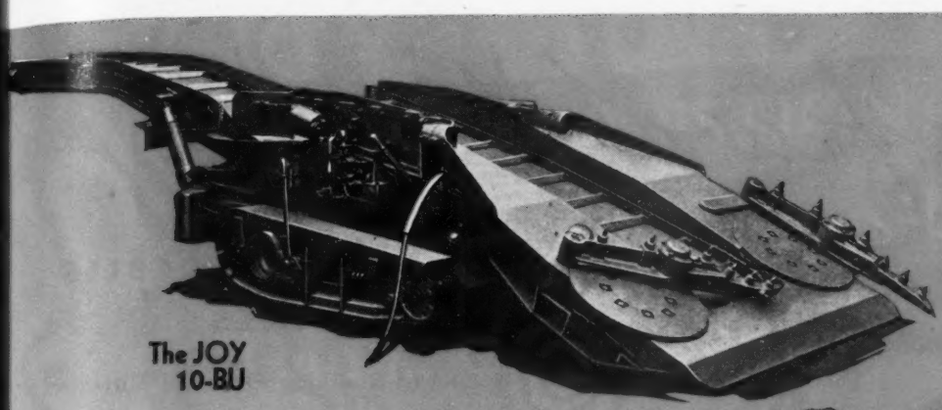
The JOY-M & C Underdrive Electric Shaker

● The JOY Manufacturing Co. who pioneered some of the first mechanization programs, have long been identified with economical load-

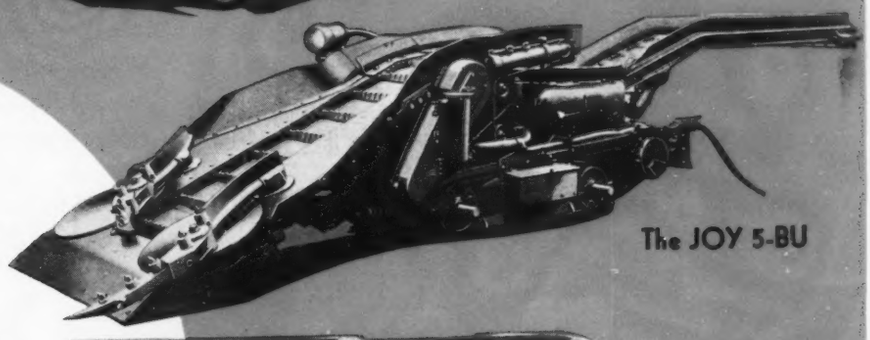


The JOY-M & C Side Drive Electric Shaker

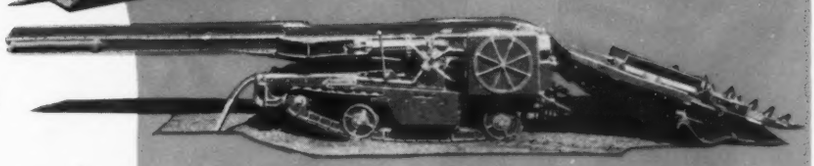
The JOY Plant



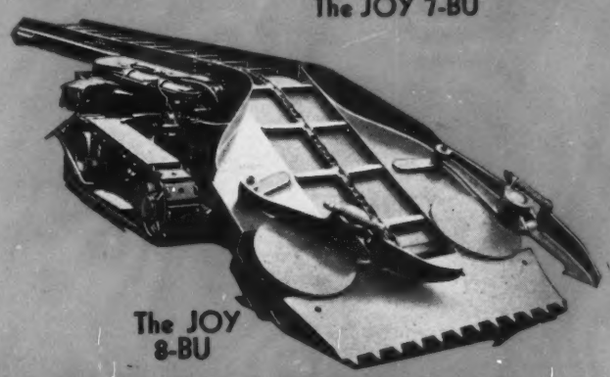
The JOY 10-BU



The JOY 5-BU



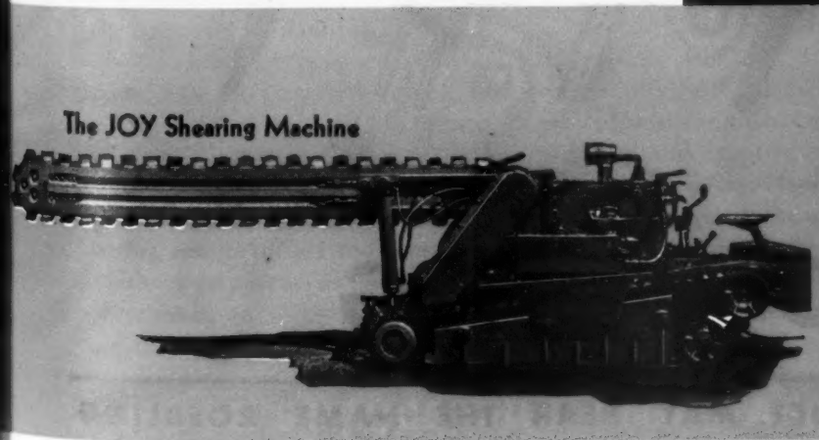
The JOY 7-BU



The JOY 8-BU

ing in high, medium and low seam properties. They have established enviable records for low cost production and are filling a definite need in the coal producing properties of the United States.

Mavor & Coulson products are recognized for their low cost production in practically all of the coal producing countries of Europe. M & C cutting machines and conveyors are being used profitably throughout the world. Combined Joy-Mavor & Coulson represent the ultimate in cutting, loading and conveying equipment; in short, they offer Model Mine Mechanization. Consult Joy on all loading, cutting and conveying problems.



The JOY Shearing Machine

THE JOY MANUFACTURING COMPANY

FRANKLIN ~ PENNA.

Just a few of Many

ELECTRICAL WIRES AND CABLES FOR COAL MINES

There are over 60 types of Roebling Electrical Wires and Cables. Merely a few of the types most used by coal mines are shown. ¶ The nearest Roebling office would welcome your inquiry for further information or samples.

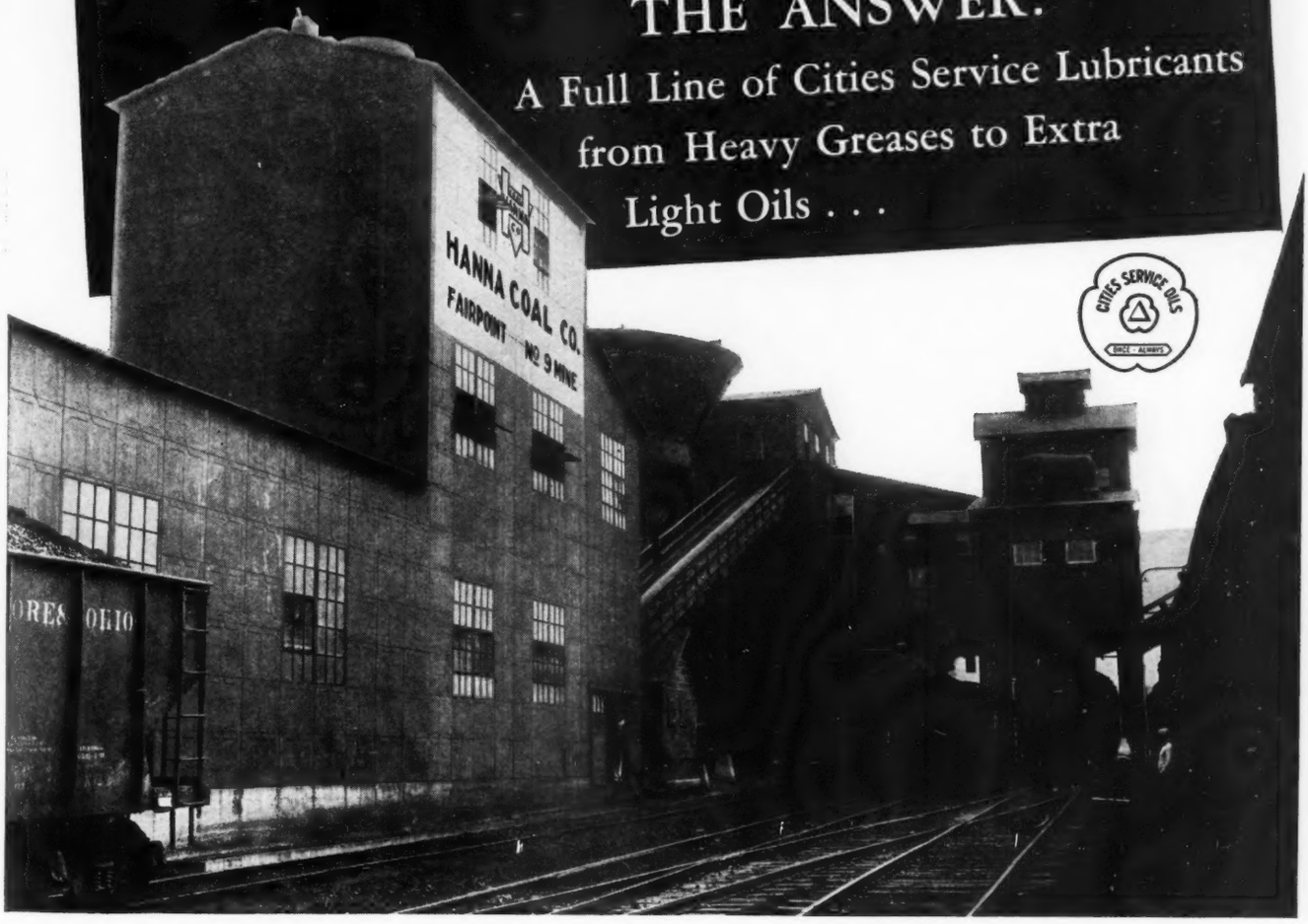
JOHN A. ROEBLING'S SONS COMPANY, TRENTON, N.J.
Branches in Principal Cities

By ROEBLING

ONLY A FINE PRODUCT MAY BEAR THE NAME ROEBLING

QUESTION:
Whose lubricants helped Hanna Coal Company win honor?

THE ANSWER:
A Full Line of Cities Service Lubricants from Heavy Greases to Extra Light Oils . . .



CITIES SERVICE congratulates the Hanna Coal Company on its magnificent record and is proud of the opportunity its lubricants were given to help this progressive company win the coveted honor of being featured in the 1934 Model Mining Number of Coal Age.

The Hanna Coal Company applied the same acid test of money-saving results to oils and greases as to the equipment on which they were used.

Cities Service lubricants are used exclusively by Hanna Coal Company in its five most important mines to assist in increasing production and in lowering unit costs. Many special lubrication problems were solved successfully, both above and below ground, with the aid of Cities Service products and engineering service.

This same full line of service-tested Cities Service products and the same expert engineering service are available to help you produce honor-winning, money-saving results from your equipment. Write, wire or telephone to your nearest Cities Service subsidiary today and let us, without obligation on your part, tell you how we can save money and produce more efficient operation for your company.

CITIES SERVICE OILS AND GASOLENES

MAIL THIS COUPON TODAY

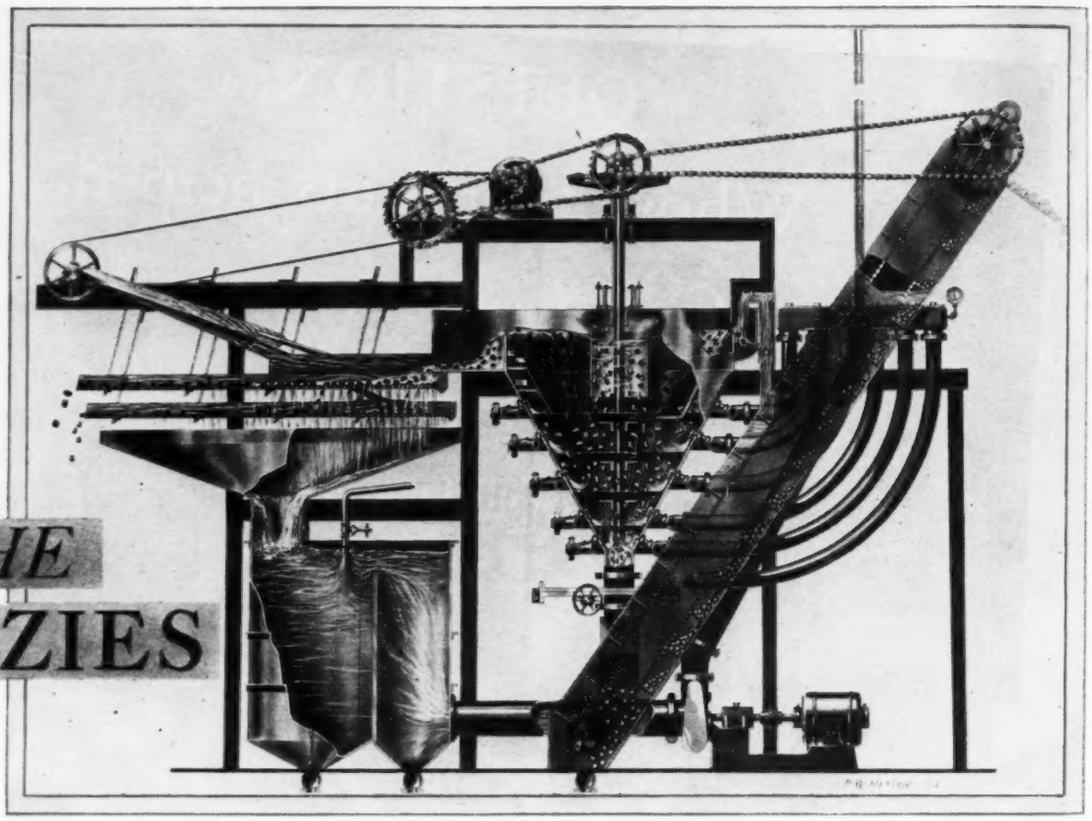
CITIES SERVICE
Room 731, 60 Wall Street
New York, N. Y.

Gentlemen: Without obligation on my part, please let me have your suggestions on how I may increase my machinery's efficiency and lower my operating costs.

Name _____

Address _____

City _____ *State* _____



THE MENZIES

CONE SEPARATOR

for either existing or new preparation plants

A coal cleaning machine that is simple and rugged, automatic in operation, utilizing only water and the refuse contained in the feed, to produce a product that meets present standards of low ash content with little or no pure coal lost in the refuse.

A system developed by practical engineers having intimate knowledge of coal preparation problems—designed for use in either new or existing structures—and to produce a high quality product at low installation, operation and maintenance costs.

The Menzies Cone Separator is in successful daily operation at a number of Anthracite Collieries. We are prepared to show you several Separators now in operation.

If *ECONOMICAL* cleaning is one of your problems, consult us. Let us make recommendations, show designs and layouts and prepare cost estimates—without obligation.

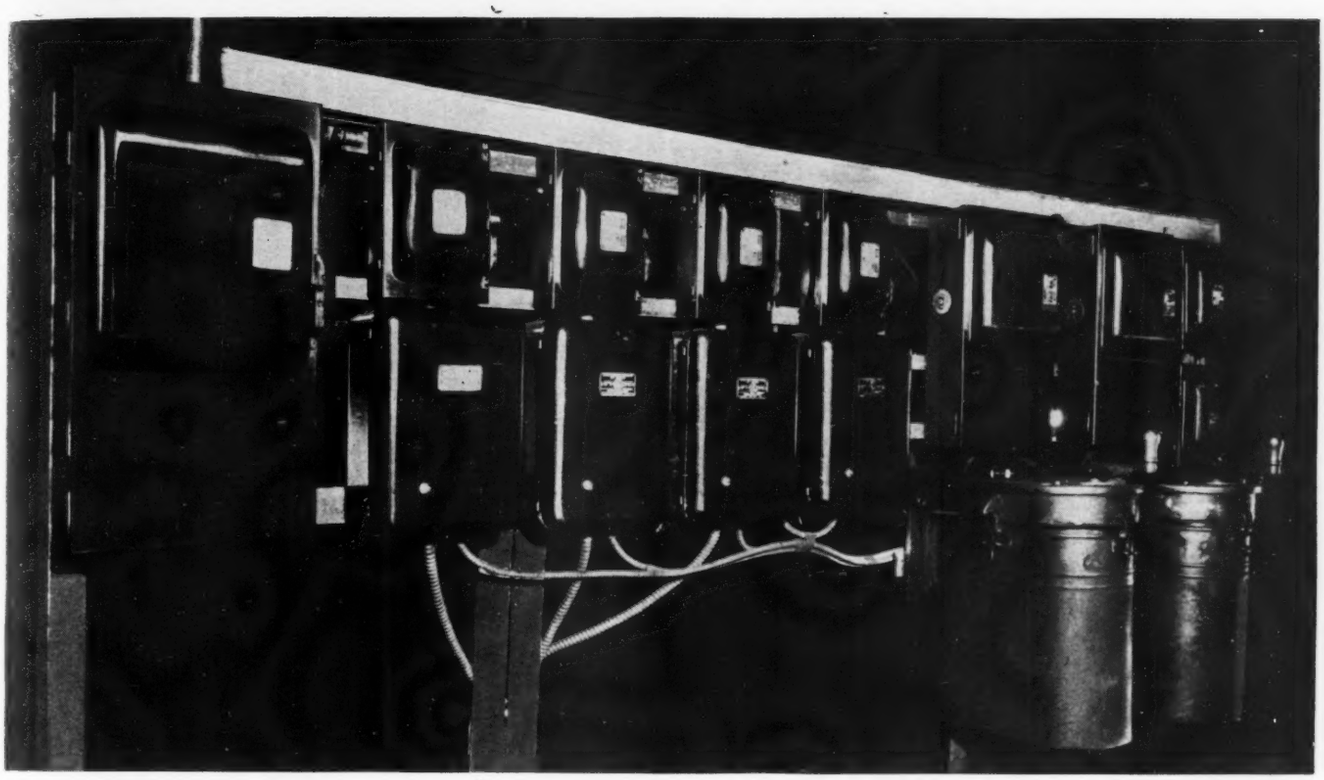
If you haven't seen our new Bulletin No. 1, write or phone us today.

MENZIES SEPARATOR CO.

416 Scranton Electric Building

Phone: Scranton 2-8461

SCRANTON, PA.



TRUMBULL SAFETY SWITCHES *lead again . . .* at "HANNA COAL"

Trumbull Safety Switches were selected for this installation at the Willow Grove Mine of the Hanna Coal Company—famous for modern methods in the mining and preparation of Ohio bituminous coal.

The Switches shown range from 30 to 200 Amperes in capacity. All are rated at 575 Volts and control motors which drive shaker screens, conveyors, loading booms, etc., in the Willow Grove Tipple.

Trumbull Industrial Switches being of unusual mechanical and electrical strength have found acceptance throughout the Coal industry.

The complete Trumbull line is listed in Catalog 16, promptly sent upon request.

Type "RB"
TRUMBULL SAFETY SWITCH

Type "RB" Switches are regularly equipped with "VYSTIPE" FUSE CLAMPS—fuses are clamped under positive mechanical pressure, your guarantee against trouble, danger and expense due to fuse contact heating.

"RB" Switches are available for either front or side operation. Side operated switches also available in cast iron boxes meeting water-tight and dust-tight specifications.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY
Plainville, Conn.

A GENERAL ELECTRIC ORGANIZATION

Make 'em long enough and strong enough!
ENSIGN-BICKFORD SAFETY-FUSE
DON'T SHORT FUSE
The ENSIGN-BICKFORD Company
DON'T SHORT FUSE
ENSIGN- Safety Fuse
FIRE the PELLETS with SAFETY FUSE
ENSIGN-BICKFORD SAFETY FUSE
Cartridge or powder
ENSIGN-BICKFORD
SAFETY FUSE
Remember
ENSIGN-BICKFORD SAFETY FUSE
when it lands?
ENSIGN-BICKFORD SAFETY FUSE
WAIT!
DON'T SHORT FUSE
ENSIGN-BICKFORD SAFETY FUSE
One Year or 100
Going
Going
GONE!
ENSIGN-BICKFORD SAFETY FUSE
AS SIMPLE as ALL THAT
ENSIGN-BICKFORD SAFETY FUSE
THE ENSIGN-BICKFORD COMPANY
SAFETY
THE CORRECT Combination IS
ENSIGN-BICKFORD SAFETY FUSE
They all tell the same story . . . and Profits
SAFETY LIES IN SKILL!
Skill in using fuse . . . that's your job.
Skill in making fuse . . . that's been our job for 99 years—100 in 1936.
The greatest advance in safety in blasting was the invention of Safety Fuse.
THE ENSIGN-BICKFORD COMPANY
SAFETY FUSE
Since 1836
SIMSBURY CONNECTICUT

Peale-Davis

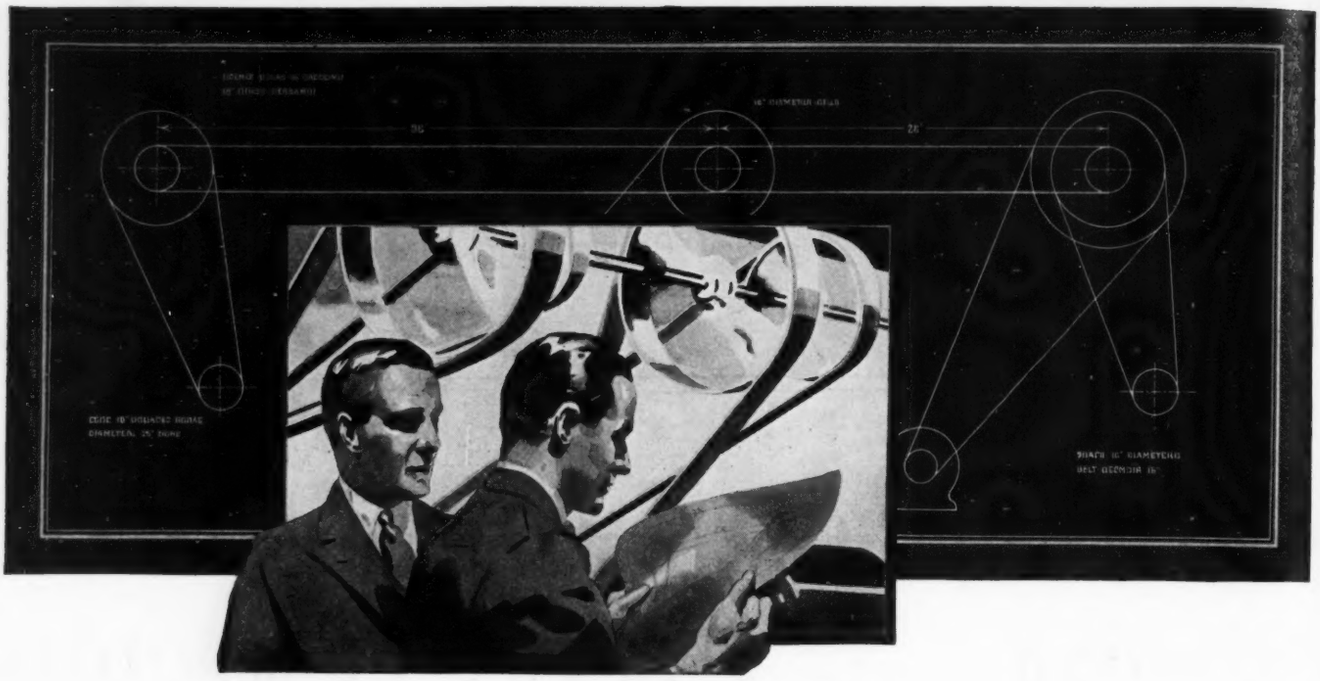
Wins important patent interference litigation . . . *OVER TWO COMPETITORS*

AS the result of extended interference litigation, Peale-Davis Company has been granted United States patent No. 1,983,487 dated December 4, 1934, carrying process and apparatus claims for modern pneumatic coal cleaning. This litigation was fought out between Peale-Davis Company, the Birtley Company, Ltd. (advertised as Licensee of American Coal Cleaning Corporation), and Roberts & Schaefer Company. By the final decision, priority of invention was awarded over both the other parties and the patent granted to Peale-Davis Company.

Several of the larger Peale-Davis plants employ the process of this patent and we shall be glad to serve all mine owners wanting this modern process. No one else can license you under this patent.

The nature and importance of this patented process in cleaning coal will be understood from the drawing (from our patent) and from the following quotations from the interference decisions:

"The subject matter of this interference is a process for separating a mixture of solid materials, constituents of which differ in specific gravity and also in size of particles. This process has particular application to the purification of raw coal, which is to say impure coal of a wide size range, and aims to classify the same into clean coal and refuse (slate, shale, bony, or rock, and the like)."



CEMENT! PAPER! STONE! OIL!

Belt "case histories" in four industries show how GTM can help you reduce costs

THAT the biggest factor in belting economy is the correct application of belts to drives is proved by the following records of Goodyear belts under vastly different operating conditions.

CASE HISTORY No. 1. New Jersey cement plant. Drive: giant rock crusher, grinding 3- to 10-ton boulders. G.T.M.—Goodyear Technical Man—specified 9-ply Goodyear Transmission Belt in 1922. Still on the job today after 12 years' service without any repairs, save cutting to take up slack.

CASE HISTORY No. 2. St. Louis paper mill. Beater drives, operating 24 hours a day. Belt failures cost 1 to 2 hours delay daily, until G.T.M. specified 16-inch, 8-ply endless Goodyear THOR Belts. Now getting three to four years, continuous service, without breakdowns—*at 50% less belting cost.*

CASE HISTORY No. 3. South Carolina stone plant. Four mean drives—vibrating screen, air compressor, main gyratory crusher and jaw crusher. G.T.M. recommended four Goodyear COMPASS Endless Cord Belts. Results: on vibrating screen—five times longer service than previous belt, saving $142. On others, approximately 100% longer service at 50% less cost per belt.

CASE HISTORY No. 4. Arkansas oil well. Pump drive. Previous belt broke five times in five months. G. T. M. advised double-deck Goodyear COMPASS Cord Endless Belt. Still in operation after 35 months' continuous operation, 24 hours a day, without a single shut-down for belt trouble!

You can enjoy the same money-saving, trouble-free service by having your belts accurately specified to your operations by the G.T.M. To secure his expert services, write Goodyear, Akron, Ohio, or Los Angeles, California — or call the nearest Goodyear Mechanical Rubber Goods Distributor.

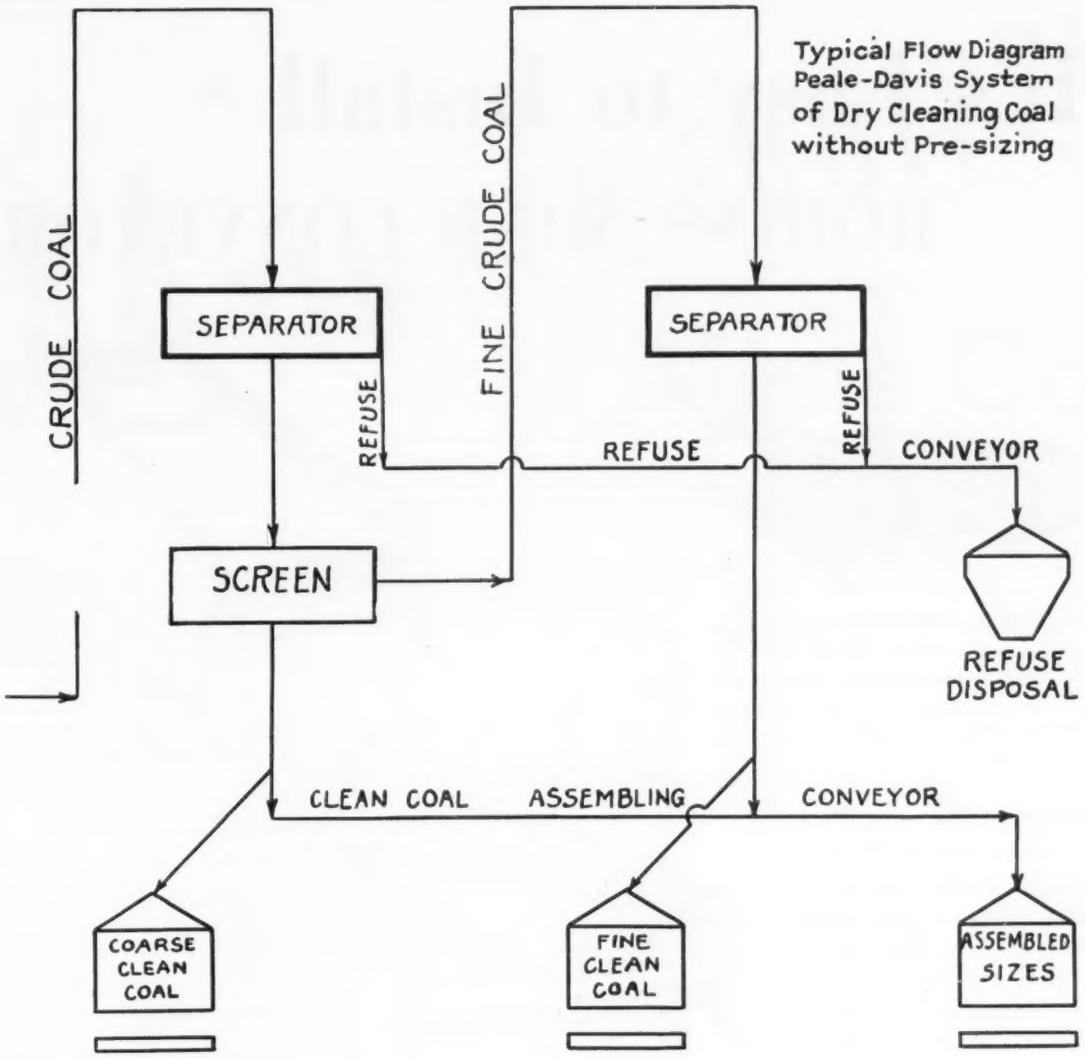
BELTS
•
MOLDED GOODS
•
HOSE
•
PACKING

Made by the Makers of
GOODYEAR TIRES

THE GREATEST NAME IN RUBBER

NRA CODE

GOODYEAR



"The steps of the process are understandable from the count, which as resolved into its elements, is copied below:

The process for the separation of . . . . a mixture of coal and a heavier material, which consists in (a) first separating the mixture by a dry pneumatic stratification separation process into at least two parts, one consisting of the larger particles of the heavier component, (b) then submitting the remainder to a screening process for the removal of the larger particles of the lighter component of the mixture in substantially pure form, (c) and submitting the remainder comprising the smaller particles of the lighter material, and the smaller particles of the heavier material to a pneumatic stratification separation process."

"It is held that Peale & Davis are entitled to make the count of this interference. The motions of Arms* and of Bramwell & Holmes** to dissolve will be denied *in toto*."

"Pursuant to the order of September 14, 1934, priority of invention of the subject matter in issue is hereby awarded to Richard Peale and Kenneth Davis, the senior party."

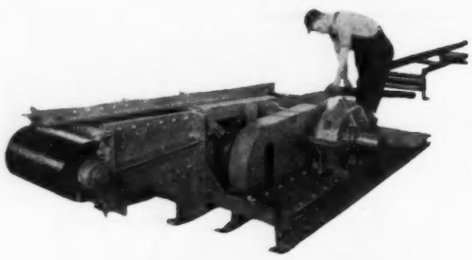
We shall be glad to communicate with all mine owners who wish to employ this modern and efficient process for pneumatic coal cleaning *under license from the owner of the patent.*

* Roberts and Schaefer Co., Assignee
** The Birtley Co. Ltd., Assignee

PENNSYLVANIA MINING MACHINERY CORP.
ST. BENEDICT, PA.
2007 GRAYBAR BLDG. • • • • • NEW YORK CITY
Fairmont Mining Machinery Co. Licensed Sales Representative, Fairmont, W. Va.

It's Easy to Install

ROBINS MINE CONVEYORS



THE HEAD SECTION with tandem drive and reducer which, with the motor, may be mounted on either side of the conveyor and may be easily moved from one side to the other.

Standard intermediate section of
FLAT BELT MINE CONVEYOR

ROBINS MINE CONVEYORS, a new design featuring overall strength and heavy sections but unit light weight for practical handling, are so built that anyone can install them — *without the use of tools and without special skill or experience.*

Standard intermediate section of
TROUGHED BELT MINE CONVEYOR

LEHIGH VALLEY COAL CO. recently purchased Robins Mine Conveyors for their Spring Mountain and Humbolt Collieries. They were easily and quickly installed by their own men, *requiring no assembly drawings.*

¶ The fact that any piece, except head and tail sections, can be easily handled by one man is an important factor in quick and inexpensive installation or extension of length. ¶ There are no loose pins, bolts or nuts to get lost, nor are any tools required to dismantle or assemble. ¶ Non-corrosive metals are used where essential. ¶ Compactness permits use in very low headroom. ¶ Vertical flexibility is provided at every joint without sacrificing lateral stiffness. ¶ The belt is reversible so that supplies or parts may be carried into the mine. ¶ Both the troughed and flat belt types are equipped throughout with anti-friction bearings and are made in all widths.

ROBINS CONVEYING BELT COMPANY

15 Park Row, New York

Boston
Charleston, W. Va.
Cleveland
Detroit

MATERIAL HANDLING ROBINS EQUIPMENT

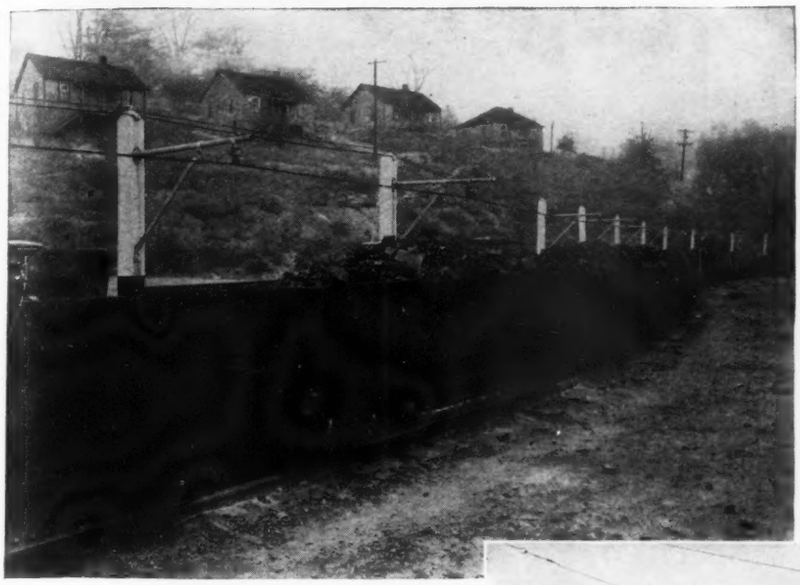
Representatives in other principal cities

Old Colony Bldg., Chicago

Philadelphia
Pittsburgh
London
Johannesburg

★ 344 TIMKEN-EQUIPPED Mine Cars

ARE OPERATED BY THE HANNA COAL COMPANY



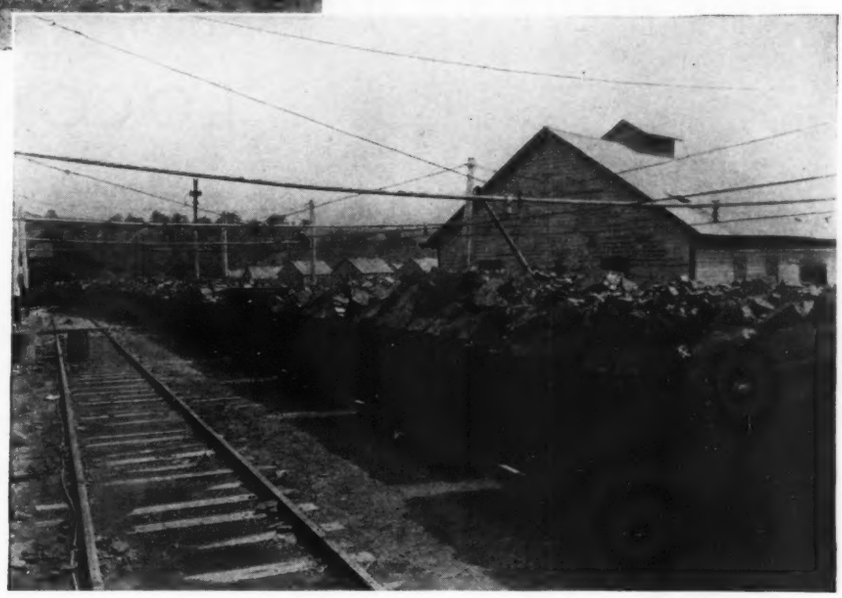
A trip of 32 Timken-equipped cars hauled by a 10-ton locomotive negotiating a steep grade at Fairpoint Mine No. 9.

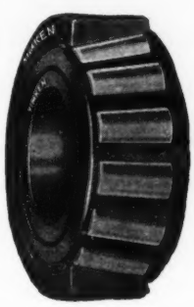
The Hanna Coal Company is one of 1,000 leading mine operators who have found that it pays to use Timken Bearing Equipped mine cars.

There are 94 Timken-equipped cars, each of 160 cubic feet capacity (between 5 and 6 tons) in service at No. 9 mine, Fairpoint, Ohio; 200 Timken-equipped cars at Dillon No. 1 mine; and 50 Timken-equipped cars at Piney Fork No. 1 mine, making a total of 344 cars in operation on Timken Bearings.

Timken Bearings were first introduced to the mining industry in 1920. They have been the dominant anti-friction bearings in mine cars ever since. There is no substitute for Timken engineering experience, Timken manufacturing precision and Timken financial responsibility.

A trip of Timken-equipped cars at Piney Fork Mine No. 1.





THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

TIMKEN TAPERED ROLLER BEARINGS

MIDVALE

GOOD
WEATHER
OR
BAD

Your mine or quarry's output depends on

LOCOMOTIVE TIRES

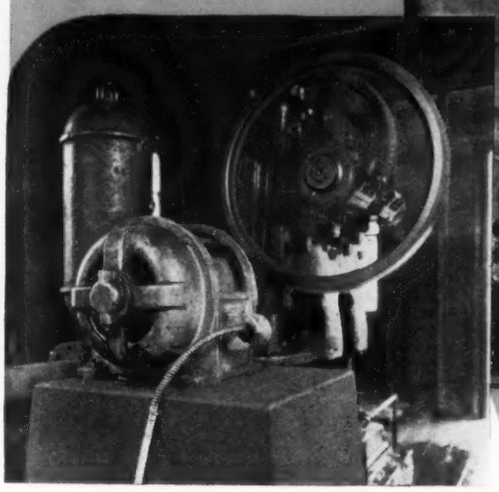
Let all your other operations be as efficient as you please — in the end that old iron mule gives the answer as to whether or not the stuff gets out. Midvale tires have given super service — everywhere. Why? Because Midvale tires are literally tool steel. They withstand the abrasive conditions of mine and quarry. You know how inconvenient and costly locomotive shut-downs are. Your best insurance is Midvale tires.

THE MIDVALE COMPANY
NICETOWN, PHILADELPHIA

Offices: NEW YORK—CHICAGO—PITTSBURGH
WASHINGTON—CLEVELAND—SAN FRANCISCO

More DEMING PUMPS AT HANNA *than any other make*

Deming Vertical Triplex Pump used at No. 9 Colliery for pumping water onto refuse banks to prevent fire.



Deming Deep Well Turbine Pump installed at No. 9 Colliery of Hanna Coal Co. for supplying water to the Link-Belt Simon Carves Washery.

One of several Deming "Oil-Rite" 5 x 5 in. piston pumps with all chrome water end in mine gathering service at the Hanna mines. These pumps are handling especially bad water.

THERE are good reasons why the Hanna Coal Company uses more Deming Pumps than other kinds.

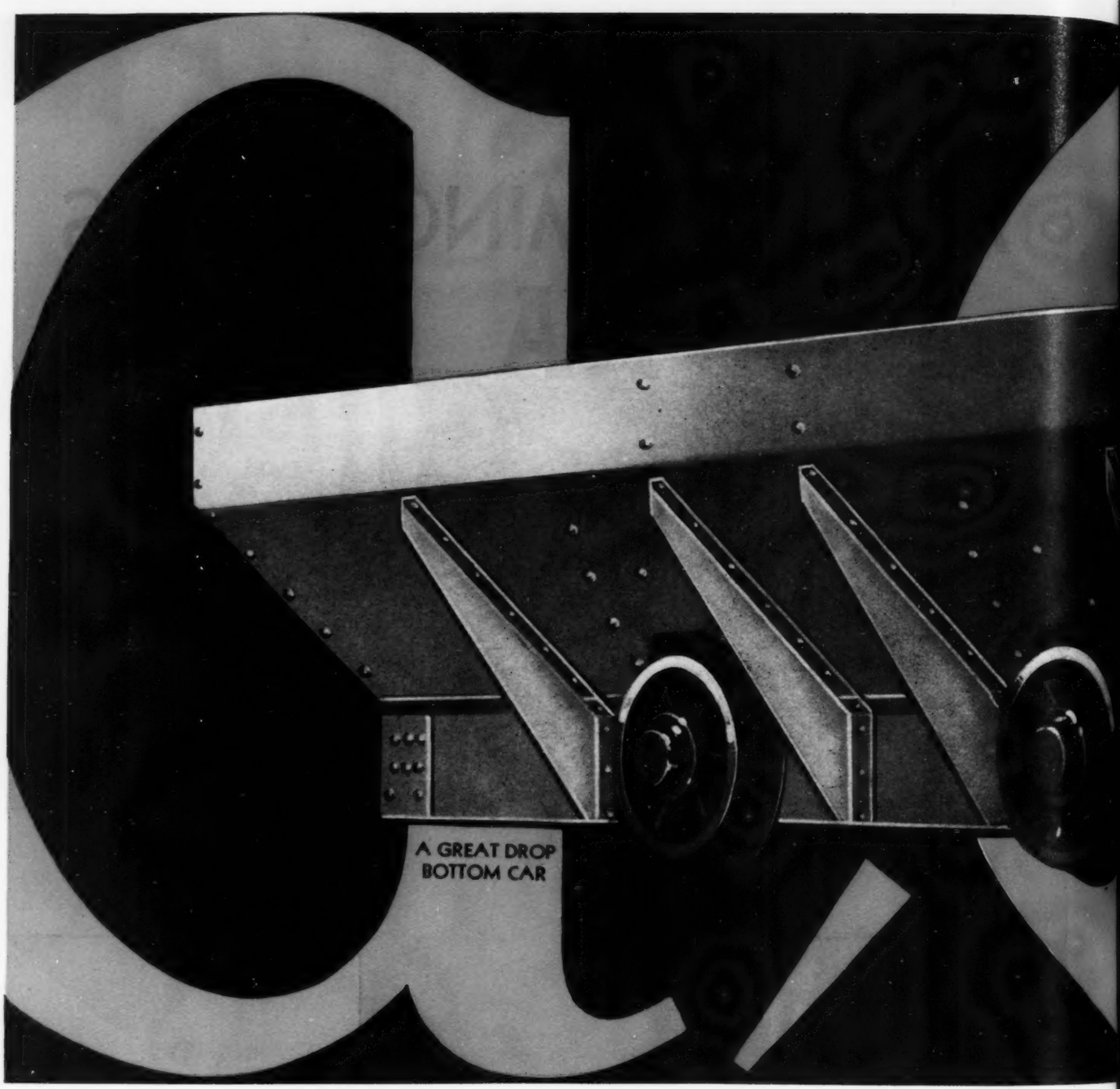
Designed and built to resist rust and corrosion, and exceptionally sturdy, Deming Pumps withstand rough usage under the worst conditions.

The wide variety of standard types and sizes makes for economy in first cost as well as in operation. A Deming engineer will be glad to help you make correct selections.

Send for catalog of Deming Pumps for mine service.

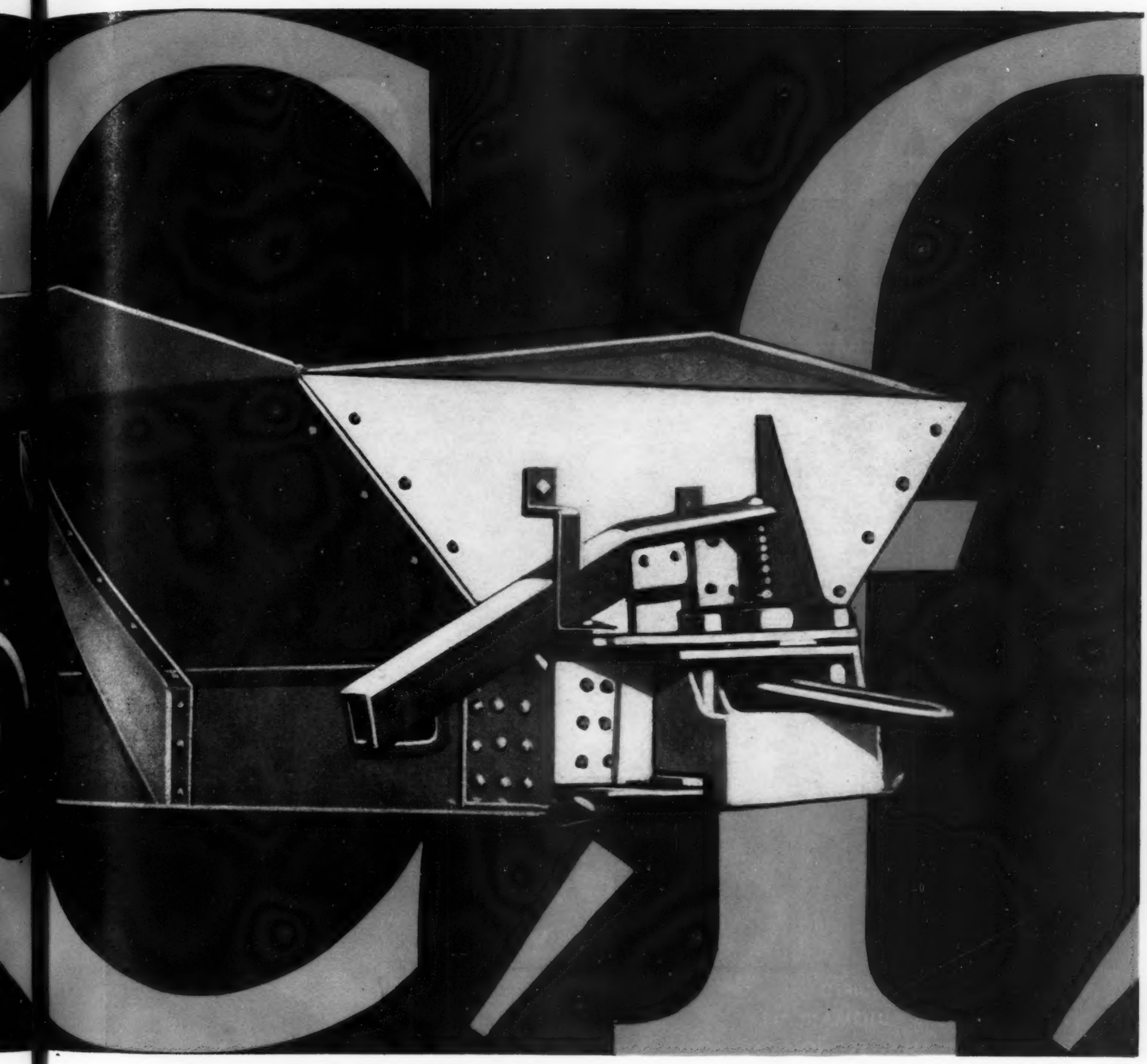
THE DEMING COMPANY • SALEM • OHIO

Established 1880



You need a strong well-designed car.—Here it is!

When you order a.c.f. mine cars you get more than full value from every tangible standpoint—you also get important "Plus Values" which cannot be expressed in blue prints or specifications . . . . The



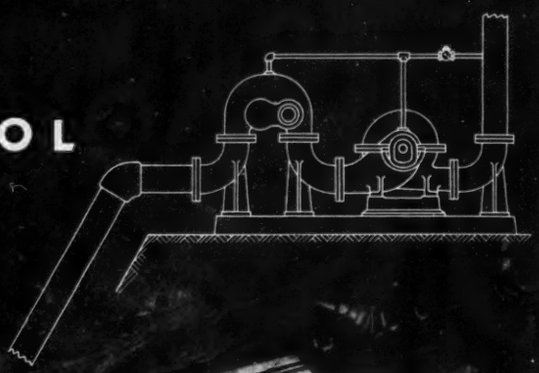
comfortable knowledge that every detail of design, material and workmanship will be exactly as specified or better—represents "Plus Values" that can only be fully assured by mailing your orders to A.C.F.

AMERICAN CAR AND FOUNDRY COMPANY

New York · St. Louis · Chicago · Pittsburgh · Cleveland · Berwick, Pa. · Bloomsburg, Pa. · Huntington, W Va. · Terre Haute, Ind.

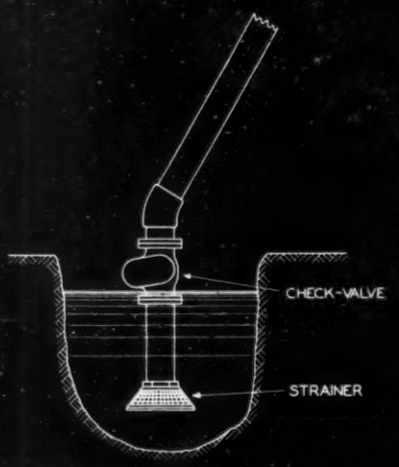
HAZLETON

DIP PUMP CONTROL



NO FLOAT SWITCH REQUIRED
STARTS AND STOPS AUTOMATICALLY
SIMPLE—DEPENDABLE—ECONOMICAL

Write for details



BARRETT, HAENTJENS & CO.
HAZLETON, PA.

Pittsburgh - - St. Louis - - Birmingham
Milwaukee - - - - - Houghton, Mich.

WARWOOD NEW PROCESS
TEMPERED MINING MACHINE BITS

Close grain carbon steel. Points hardened, ready for service

HANNA equips its Oldroyds and Little Giants with WARWOODS

The Bits and Augers that reduce sharpening costs

At the Hanna mines, where equipment is severely tested in actual service in No. 9 mine, (operated in triple shift) it is not surprising to find that the cutter bits for their 48 mining machines are WARWOODS. All the auger drills stocked in recent months are WARWOODS also. The company operates 30 or more electric drills, using 3 ft., 6 ft., and 9 ft. WARWOOD augers.

WARWOOD'S NEW PROCESS TEMPERED MINING MACHINE BITS

Produced by an absolutely new process for which application for patent has been made.

By this process mining machine bits are produced with the following improvements.

Each bit identical in shape and size. They are forged at a regulated heat which prevents burning the steel. The points are free from forging defects, each one sound and ready to cut coal. Shape has approved angle and clearance. Will follow through sharpening machine without special shaping. Saves wear and reduces maintenance cost on sharpening machines.

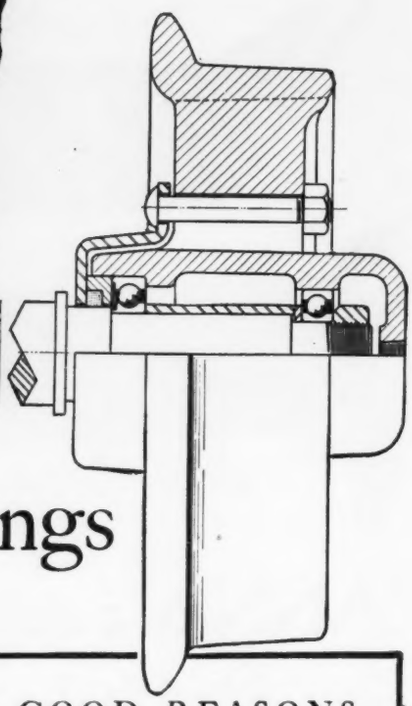
WARWOOD'S Mogul Power Augers. Close grain carbon steel. All lengths. Sharp edge heavy centre will not whip or bend.

COAL TOOLS SINCE 1854

WARWOOD TOOL COMPANY

Wheeling, W. Va.

Roll ON TO LOWER HAULAGE COSTS



..on FAFNIR Ball Bearings

Banish friction—not partly, but wholly—from your mine cars and you slash the cost of moving a ton of coal. Mine operators are profiting this way by rolling their cars on Fafnir Ball Bearings, and the trend towards Fafnirs is rapidly increasing.

Leak-proof housings keep the lubricant where it belongs, and large lubricant space cuts down the frequency of re-lubrication; but when it *is* desirable to add lubricant it may be done *without removing the wheel.* The deep races, large balls and rugged construction of Fafnirs assure ample capacity for the most severe service.

Facts about cutting costs with Fafnirs are yours for the asking. Write for proof to the *Mine Division* of THE FAFNIR BEARING COMPANY, *New Britain, Conn.*

5 GOOD REASONS

for equipping your mine cars with Fafnir Ball Bearings

1. **POWER SAVING** . . . because ball bearings are admittedly the most frictionless and can absorb severe side thrusts.
2. **LUBRICANT SAVING** . . . through the use of grease within leak-proof housings.
3. **EASY REMOVAL** . . . because the bearing assembly remains in place on the axle journal. A monkey wrench is the only tool needed.
4. **FULL LOAD CAPACITY** . . . with the two heavy-duty maximum-type Fafnir Ball Bearings.
5. **FOOL-PROOF** . . . a simple assembly requiring no special skill or experience — no bearing adjustment ever needed.

And not only for mine cars but for all mine equipment — Fafnir Ball Bearings offer convincing savings.

FAFNIR BALL BEARINGS

B.W.H.
CONVEYOR
BELTS

B·W·H

There's a B·W·H· BRAND to MEET EVERY N

· BULL DOG · · SILVER KING ·

THE belt for "Supreme Duty". This means the severest possible service under the most difficult conditions. Bull Dog conveyor belts carry the extremes of weight and abrasion that ores, crushed rock and other mine and quarry materials can inflict. Bull Dog is the belt to specify whenever you have a most difficult and exacting conveying problem.

These are the construction details. Weight of duck —28, 32 and 36 oz. Tensile strength of covers— 3500 to 4000 lbs. Friction between plies—20 to 24 lbs. Breaker strip when specified.

IF your conveying job consists of crushed stone, broken glass, sharp sand, cement rock, lump coal, char, wet sugar and similar materials, we recommend Silver King.

This belt is built for "Superior Duty". It is designed for all heavy duty work which does not require the supreme quality of Bull Dog.

The weight of duck used is 28, 32 and 36 oz. Tensile strength of covers—2500 to 3000 lbs. Friction between plies—16 to 19 lbs. Breaker strip when specified.

BOSTON WOVEN HOSE &

CONVEYOR BELTS

RY NEED of RE-AWAKENED INDUSTRY

· AUROCHS · · IRONCLAD ·

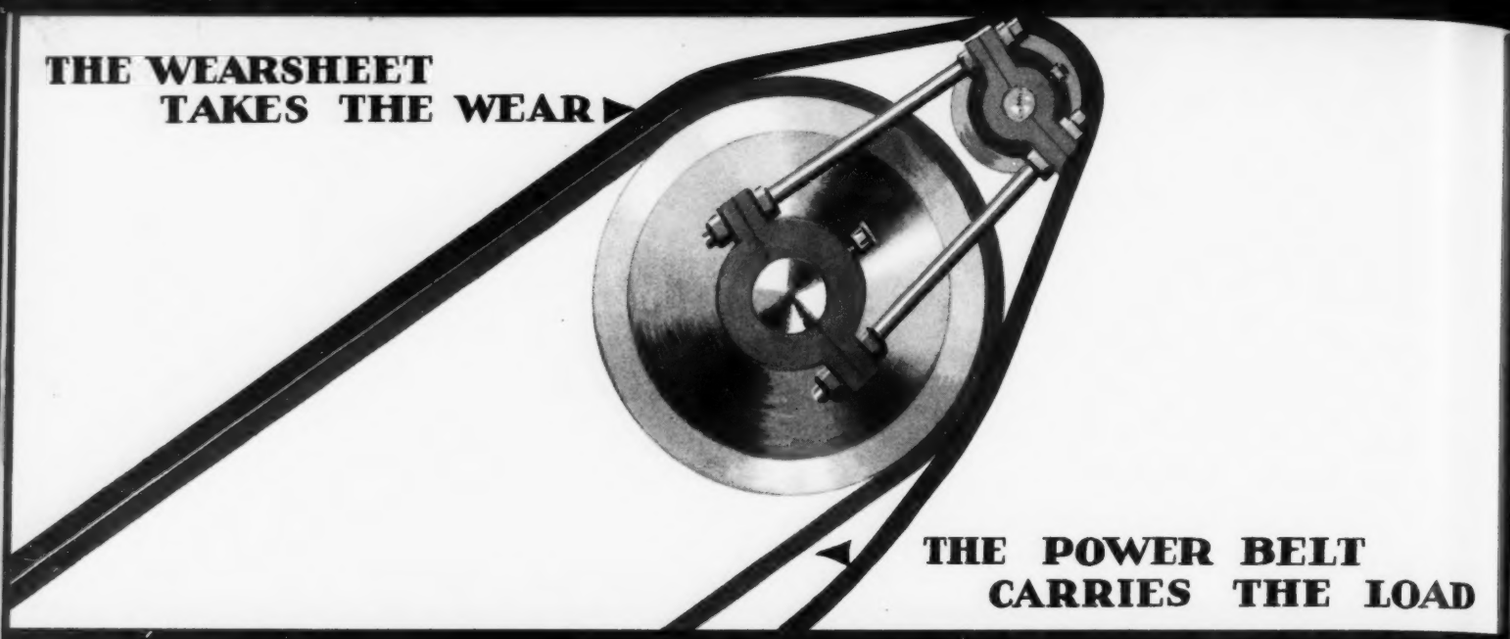
WE call Aurochs our "Hard Duty" belt because it is designed for general all-around hard duty such as coarse gravel, sand, hard coal and the ordinary run of stone and rock. Specify Aurochs wherever conditions call for a high quality belt, better than average in general quality, but where the expense of Silver King or Bull Dog is not justified by the actual service involved.

It is constructed of 28, 32 and 36 oz. duck. Tensile strength of covers—1400 to 2000 lbs. Friction between plies—12 to 15 lbs. Breaker strip when specified.

THIS is the popular "Average Duty" belt. Iron Clad is built with the same careful construction and superior materials found in all B.W.H. belts, with the details of construction scaled down to be thoroughly competitive in price—a belt that is economical to install, efficient in service. We recommend Iron Clad for handling small sized stone, ordinary sand and gravel, soft coal, cement, lime, chips, pulp, fine crushed stone and for general conveying service.

Weight of duck—28 and 32 oz. Tensile strength of covers—800 to 1000 lbs. Friction between plies—12 to 15 lbs.

RUBBER CO. CAMBRIDGE MASS



The most important development in the history of belt conveying

The DUPLEX SYSTEM

definitely lowers your cost per ton

THIS statement is easily proved—from actual operating records. The Duplex System saves money because it is built on a new principle—a power belt traveling over the regular head and tail pulleys, and a separate removable wear-sheet which rides on the power belt's back and runs over extra head and tail pulleys to keep it in proper alignment. The power belt transmits the motive power; the wear-sheet carries the load and absorbs the wear.

Repeat orders prove its value. Several plants that originally installed but one now have from two to five Duplex Systems running, with further installations scheduled as fast as old style conveyor belts wear out.

Permit our engineers to go over your specifications and determine how you can profit by the Duplex System, the most important development in the history of belt conveying.

Don't stay on the old basis, "When the cover is gone, the belt is gone".

B·W·H·

CONVEYOR BELTS

One of the Exide-Ironclad equipped locomotives operating in the mines of The Hanna Coal Co.

IMPROVED EXIDE-IRONCLADS SAVE MONEY IN MINE HAULING

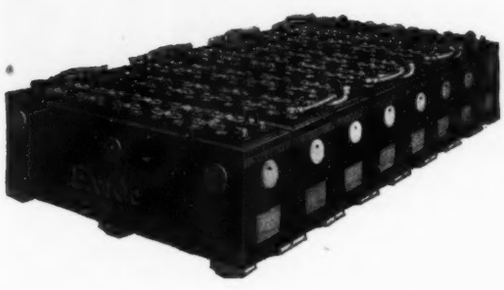
Flexibility and resiliency are features of the new Exide Mipor Separator.

Mine locomotives seem to develop new power, to become steadier and more tireless in their work when equipped with Exide-Ironclad Batteries. Year after year, Exide-Ironclads have proved their ruggedness and demonstrated that they can deliver high power ability with economy.

Their long life, low cost of maintenance and freedom from trouble are now more outstanding than ever. Exide-Ironclads have new separators of Exide-Mipor—a revolutionary improvement that is offered at no increase in price.

Exide Mipor Separators are made from vulcanized rubber, permeated by pores so numerous as to permit free diffusion of the electrolyte, and so minute as to form an absolute barrier to the smallest particles of active material. They are unaffected by heat, electrolyte and vibration — they are, in fact, the permanent storage battery plate insulator.

Why not improve your service and cut costs with these improved Exide-Ironclads? Write for new catalog on Exide-Ironclad Batteries, giving full details about the new Exide Mipor Separators.



THE ELECTRIC STORAGE BATTERY CO., Philadelphia

The World's Largest Manufacturers of Storage Batteries for Every Purpose

Exide Batteries of Canada, Limited, Toronto

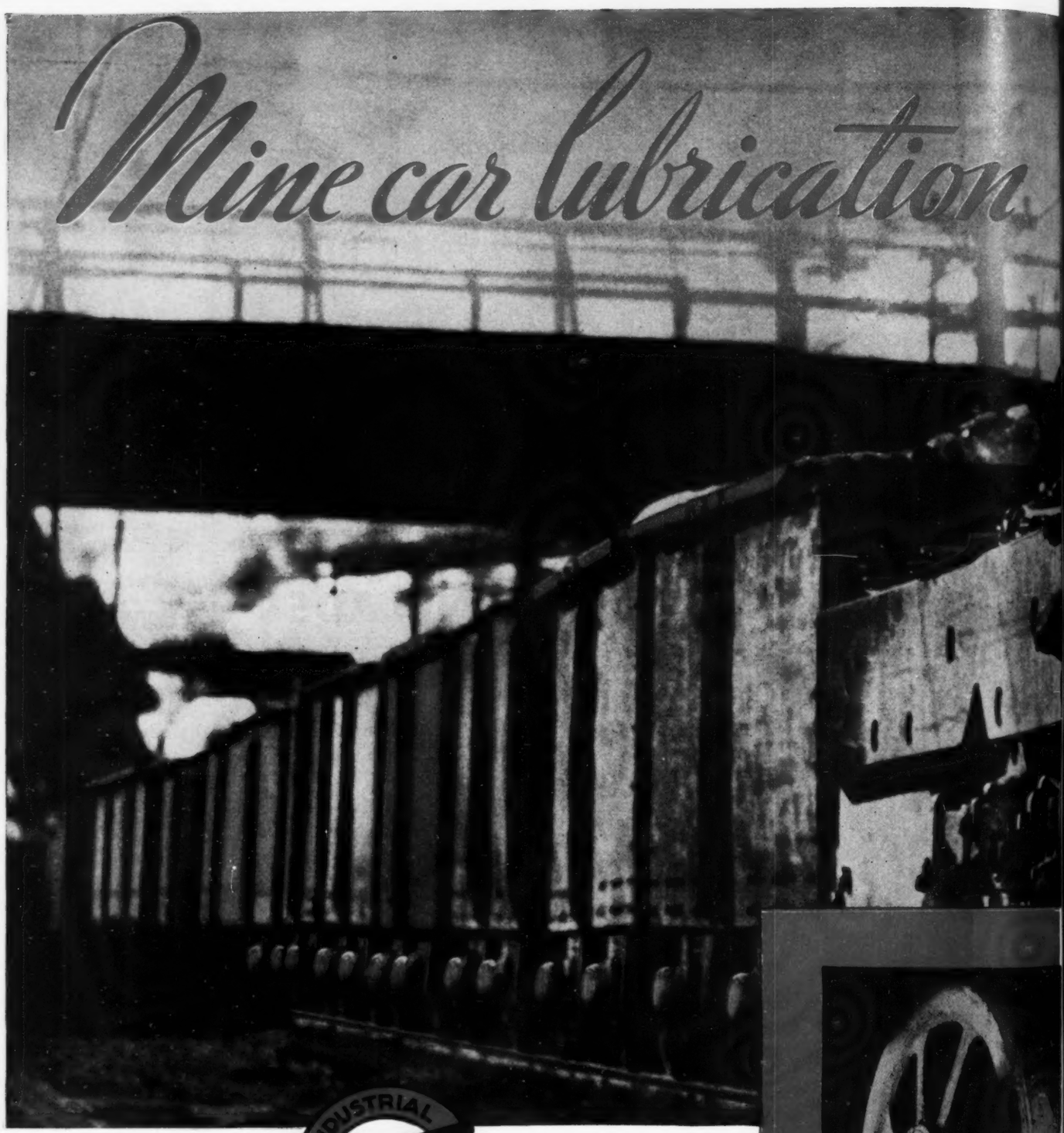
NRA CODE

Exide IRONCLAD BATTERIES

WITH EXIDE MIPOR SEPARATORS

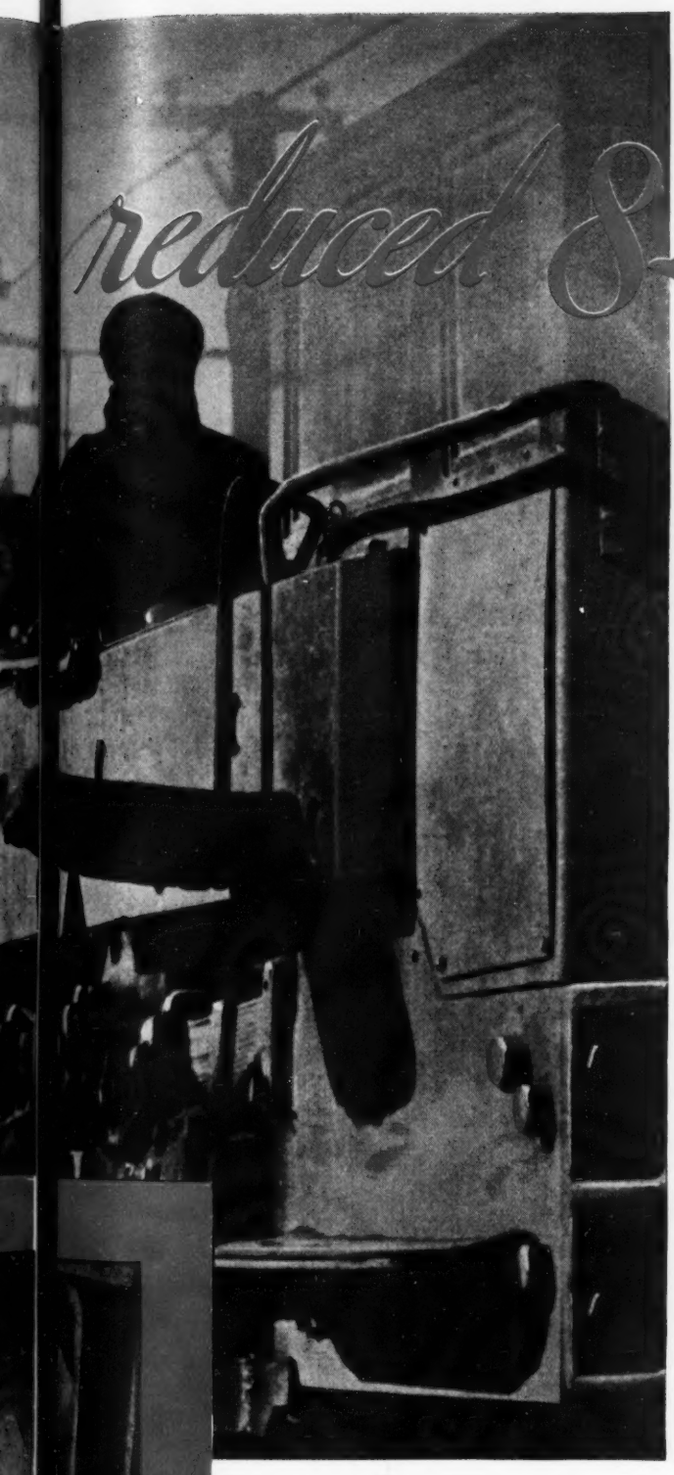
"MIPOR," REG. U. S. PAT. OFF.

Mine car lubrication



INDUSTRIAL
TYCOL
OILS-GREASES

Tide Water makes a complete line of proven lubricants for the mines; for every moving piece of equipment from the top of the breaker to the bottom level. Have a Tide Water engineer survey your needs and recommend the most efficient type of grease or oil to decrease your operating costs.



reduced 82%.....by TIDE WATER GREEN CAST GREASE

At a large mine, Tide Water Green Cast Grease replaced a conventional black oil for lubricating plain bearings on mine cars.

Result:

8 pounds of Tide Water Green Cast Grease per car every 24 hours did the job in place of 1 gallon a day per car of black oil. Lubricant cost was thus reduced from $0.12 to $0.022 daily per car — a saving of 82%.

Multiply this by the number of cars; take into consideration the saving in lubricating time; bear in mind the fact that wheel losses were cut to ¾ of their former number! Is it any wonder that mines are enthusiastic over Tide Water Green Cast Greases and are showing it by ever increasing use.

We'll tell you the secret, "a grease can be no better than the lubricating oil from which it is made." Tide Water uses a paraffine base oil stock, compounds it with Calcium Soap to make the grease "stay put" and makes the proper consistency for every service indoors or out.

We will gladly survey your needs and recommend changes which will effect savings for you. This service is freely offered. Fill in and mail the coupon below.

TIDE WATER OIL COMPANY, 17 Battery Place, New York, N. Y.

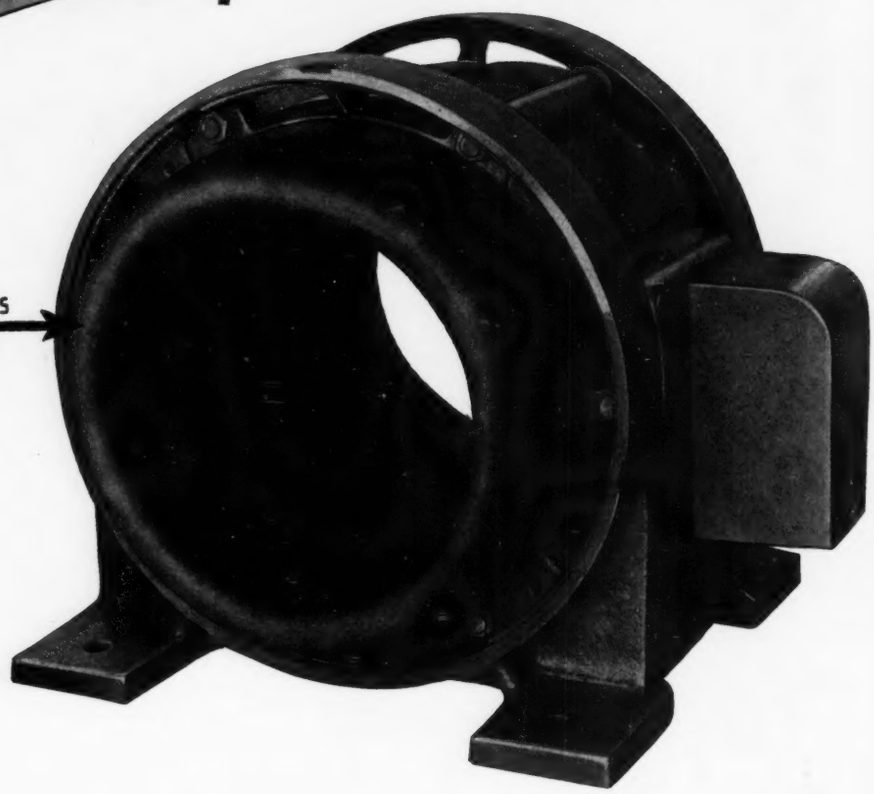
COUPON

TIDE WATER OIL COMPANY, 17 Battery Place, New York, N. Y.
Gentlemen: Please send me complete information concerning Tide Water's Green Cast Mine Greases.

Name..... Company.....

Address..... City..... State.....

Seal-Clad Motors



CONSTRUCTION FEATURES

Frame—cast steel with feet cast integral.

Stator Core—twistless, distortionless, and self supporting.

Stator Windings—Seal Clad; mechanically protected from dust and moisture.

Rotor—indestructible; bars silver brazed to end rings.

Ball Bearings—mounted in dust tight cartridges.

Sleeve Bearings—sealed enclosure prevents entrance of dust and dirt and escape of lubricant.

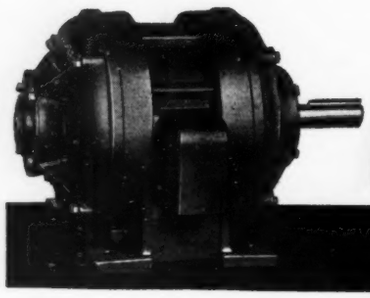
Permanent Coil Protection

WITH the new Seal-Clad construction, introduced by Allis-Chalmers, induction motors are now provided with hard, smooth Bakelite shields sealed over the stator coils, giving protection against damage from metallic dust, grit, oil, moisture, mild acids and other agents injurious to insulation.

SEAL-CLAD motors are of the open type and are built in ratings up to 25 hp, 1800 rpm.

See nearest Allis-Chalmers district office or write for Leaflet 2182.

ALLIS-CHALMERS MANUFACTURING COMPANY
MILWAUKEE, WISCONSIN



ALLIS-CHALMERS

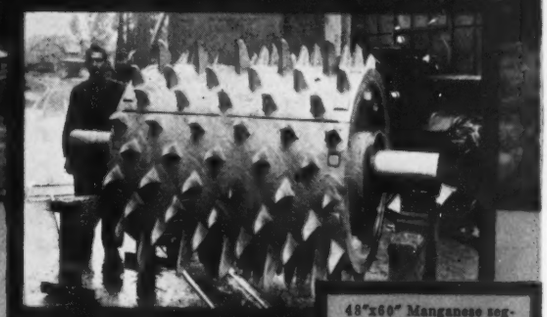
SEAL-CLAD MOTORS

P. & R. BUYS TWO NEW BLACK DIAMOND CRUSHERS

St. Nicholas Central District Breaker of the Philadelphia & Reading Coal & Iron Company.

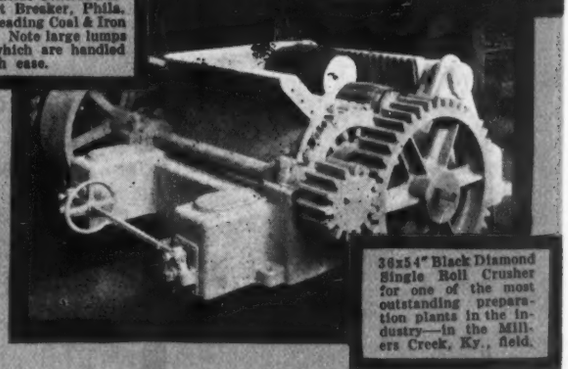
Big coal mining companies are buying

BLACK DIAMOND *Single Roll Crushers*



48"x60" Manganese segment roll for one of two Black Diamond Crushers installed at St. Nicholas Central District Breaker, Phila. & Reading Coal & Iron Co.

One of the Black Diamond Single Roll Crushers at St. Nicholas Central District Breaker, Phila. & Reading Coal & Iron Co. Note large lumps—which are handled with ease.



36x54" Black Diamond Single Roll Crusher for one of the most outstanding preparation plants in the industry—in the Millers Creek, Ky., field.

The crushers here illustrated have been installed recently by two of the largest coal mining companies in the United States — one located in the anthracite and one in the bituminous field. A significant indication of the way progressive coal companies are turning to Black Diamond Single Roll Crushers. Following are some of the reasons:

Distinctive Features

All sizes of crushers built in heavy four-sided one piece frames for any capacity either with or without instantaneous adjustment and automatic steel toggle protection. Exceptionally high crushing zone with wide throat for larger feeds. Longer curved crushing plate for greater tonnages of uniform sizes. Low head room. Cast iron or steel or cut steel gears — babbitted or split phosphor bronze bearings — solid — removable tooth or segment roll — of any size teeth required. Reversible wearing tips — compression grease cups or Alemite Lubrication.

Operating Advantages

These crushers will produce a relatively uniform product of desired size in one operation with a minimum of slabs, oversize and fines, from large sized feed — Lowest first cost — Low power consumption — Large hopper — Can be choke fed — Maximum reduction in one operation — Easy adjustment for different sized products — Can be fed from any direction and will discharge in any direction — Tramp iron protection — Slow speed — Large Capacity — Crushes 100% of the time — Simple construction — Low head room — Working parts visible — Inexpensive repair parts easily installed — Can be quickly erected. Compact-Powerful-Massive-Durable.

McLANAHAN & STONE CORPORATION

MANUFACTURERS—FOUNDERS—MACHINISTS

ORIGINATORS OF SINGLE ROLL CRUSHERS . . . 1935 WILL BE OUR 100TH ANNIVERSARY

HOLLIDAYSBURG — Continuously in Business Since 1835 — PENNSYLVANIA

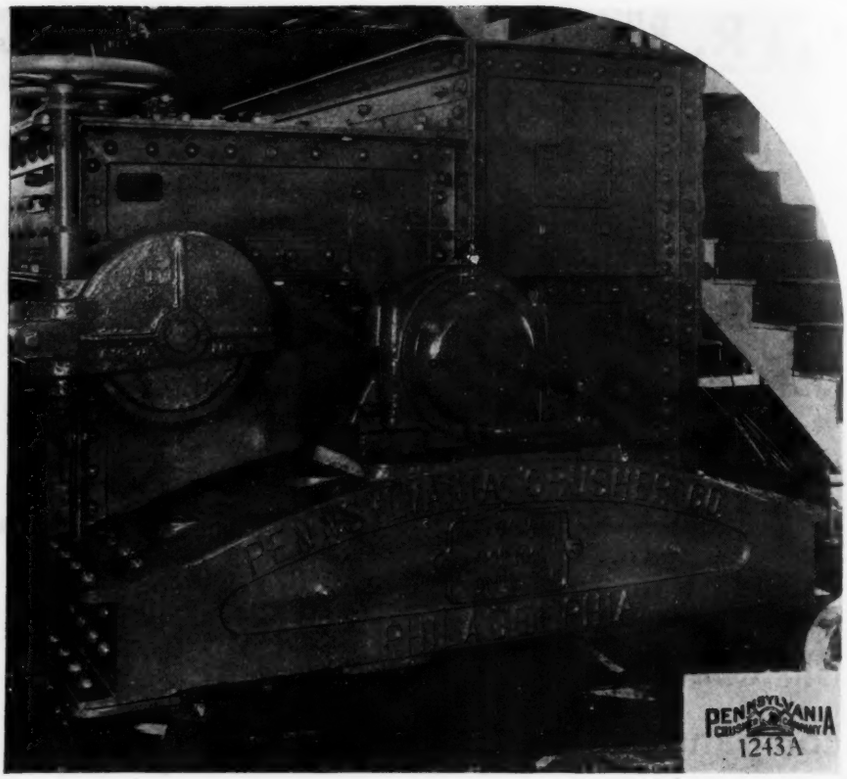
REPRESENTATIVES

Albany, N. Y.	Dayton, O.	Huntington, W. Va.	Louisville, Ky.	Oklahoma City, Okla.	Salt Lake City, Utah
Birmingham, Ala.	Denver, Colo.	Jonesboro, Tenn.	Miami, Fla.	Philadelphia, Pa.	San Antonio, Texas
Buffalo, N. Y.	Des Moines, Ia.	Kansas City, Mo.	Mount Pleasant, Tenn.	Pittsburgh, Pa.	St. Louis, Mo.
Chicago, Ill.	Houston, Texas	Little Rock, Ark.	New York City	Richmond, Va.	St. Paul, Minn.

SKF EQUIPPED

BUILT BY

PENNSYLVANIA CRUSHER COMPANY



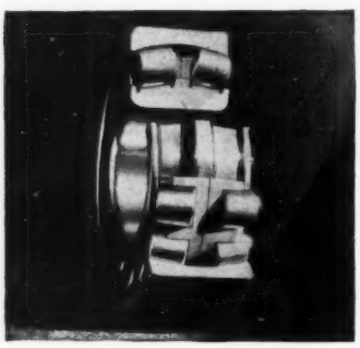
WHERE SKF GOES IN ON ANY SHAFT

SERVICE COMES OUT

IN goes coking coal, 225 tons of it! and OUT it comes, 85 per cent pulverized to pass a 1/8" square opening . . . in a job that demands tough, dependable bearings, such as two SKF's on the main shaft of this "Pennsylvania" Super-Thor Hammermill!

The SKF Spherical Roller Bearing helps coal flow smoothly, safely, certainly . . . from chunks to bits! For this is the kind of job on which the SKF Bearing has functioned for years . . . a job on which its stamina . . . its ability to take punishment . . . has been proved! And the SKF Pillow Block is sure protection for a bearing that needs no adjustment . . . that provides clean, practically frictionless operation at all times! Whether your bearing problem demands an SKF Spherical Roller Bearing, or a bearing of different type, remember this . . . SKF makes an anti-friction bearing for every need!

● You may buy a bearing as a bargain but try and get a bargain out of using it, for nothing is apt to cost so much as a bearing that cost so little



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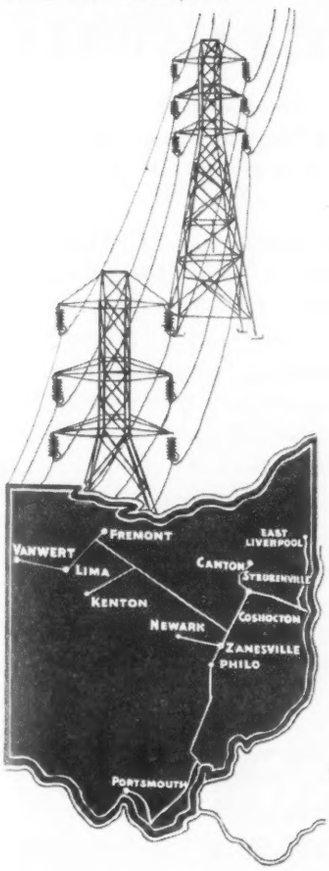
SKF INDUSTRIES, INC., FRONT ST. and ERIE AVE., PHILADELPHIA, PA.

SKF

Ball and Roller Bearings

Piney Fork Substation



ALL operations of the HANNA COAL COMPANY

are run on *PURCHASED POWER*

DURING the past twenty years it has been our pleasure to serve the Hanna Coal Company. In this time we have supplied this progressive coal producing company with the power required to keep its tonnage moving continuously at the rate of two and a half million tons a year.

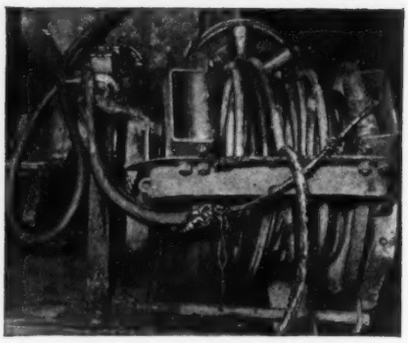
Continuous use of purchased power over so long a period by this successful operator is irrefutable proof of the economy that mine operators realize when power is purchased from the lines of a reliable central station, prepared to supply during every hour of the day any power demands that may be made upon it.

The OHIO POWER COMPANY

CANTON, OHIO

Reduce Production Delays!

use RU-BER-OID TAPE



Frayed Cables—warn probable electrical circuit failures

TOUGH, EXTRA STRONG, DOUBLE GRIPPING INSULATING TAPE PREVENTS ELECTRICAL CIRCUIT FAILURES

QUICK FACTS

1. **DOUBLE GRIP** Both surfaces are adhesive. Regardless of climate or temperature, this tape never ravels nor puckers. It stays put.
2. **EXTRA STRENGTH** Has amazing strength, toughness and durability. Withstands abrasion to remarkable degree.
3. **LONGER LIFE** Strength, toughness, adhesiveness and ability to withstand acids and alkali provide longer insulating life.
4. **MORE ECONOMICAL** Due to thickness, quality and dielectric strength, only one covering of this tape is required to thoroughly insulate.

The RUBEROID Co.

ROOFING MANUFACTURERS FOR OVER FORTY YEARS

RUBEROID—CONTINENTAL—SAFEPACK

WATSON—ETERNIT

Offices and Factories: New York, N. Y.—Chicago, Ill. Millis, Mass.—Erie, Pa.—Baltimore, Md.—Mobile, Ala.

RU-BER-OID Insulating Tape exceeds the ASTM specifications in adhesiveness by 300%, in tensile strength 26%, in dielectric strength 290%; plus values for which you pay no price premium.

ONE WAY to higher production is careful cable maintenance. Frayed, worn cables cause line losses, production delays and sometimes costly breakdowns.

When mine cables need repair, use RU-BER-OID Insulating Tape, the standard for cable maintenance since 1888. Its two adhesive surfaces completely seal the copper contacts against oxidation and fouling from dirt. The extra toughness and strength found in RU-BER-OID Tape enable it to stand plenty of punishment from abrasion without serious effect.

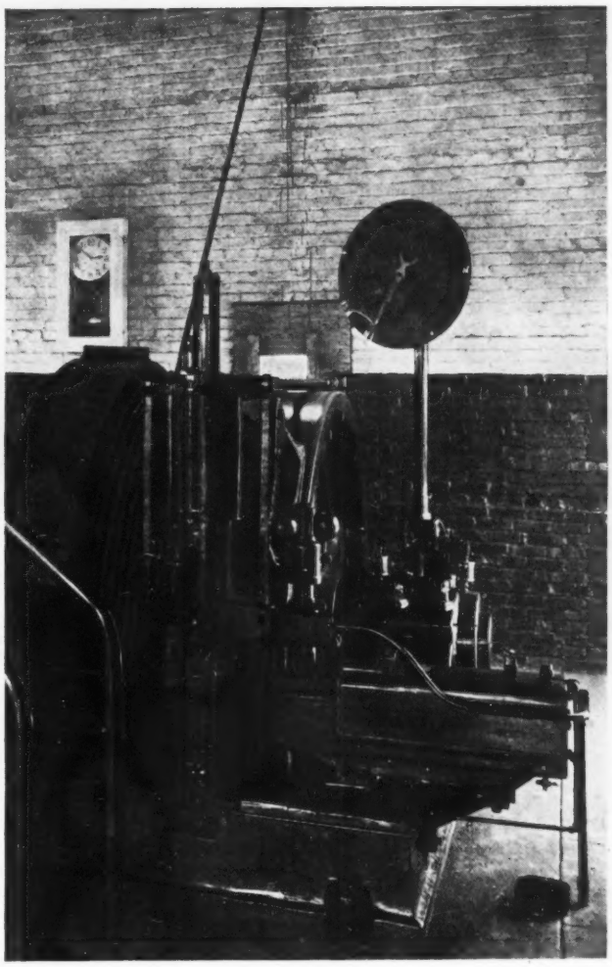
Check the quick facts about RU-BER-OID Insulating Tape. Then, order a few rolls from your favorite mine supply house. Compare Ruberoid Tape for thickness, adhesiveness and strength. Then you will understand why this product has been preferred for years by coal operators everywhere.

RU-BER-OID FORMERLY P&B **INSULATING TAPE**

GENUINE RU-BER-OID ROOFINGS and SHINGLES—THE STANDARD FOR COLLIERIES FOR FORTY YEARS

The largest hoists at **HANNA'S** mines *were built by*

VULCAN



The illustration at right shows the Vulcan shaft hoist at No. 6 Colliery of the Hanna Coal Company, Lafferty, Ohio—the largest hoist at any of this notable group of bituminous mines. And we also furnished the two largest hoists (1300 h.p.) operated by the Susquehanna Collieries Company—a great Hanna property in the anthracite fields of Pennsylvania—together with a wide variety of smaller hoists and other important equipment.

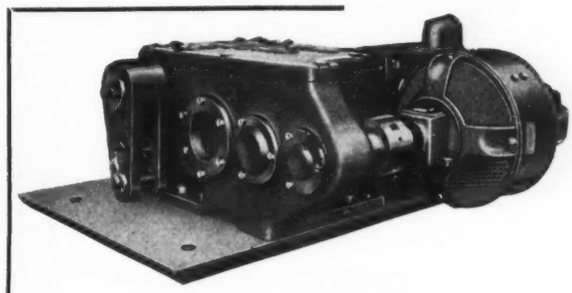
For more than 85 years the Vulcan Iron Works has been supplying coal and ore producing companies with an increasing volume of widely varied equipment, such as

Heavy Duty Electric Shafts Hoists
Steam Hoisting Engines
Self Contained Hoists
Scraper Hoists
Car Spotting Hoists
Room Hoists
Shaking Chute Conveyors
Sheaves
Cages—Skips—Gunboats
Mine Ventilating Fans
Breaker Machinery
Iron and Steel Castings
Plate Metal Work—Riveted and Welded Steam Locomotives
Trolley and Storage Battery Locomotives
Gasoline Locomotives—Geared and Electric Drive
Diesel Locomotives—Geared and Electric Drive

Correspondence invited regarding any problem involving coal handling, coal preparation or mine ventilation.

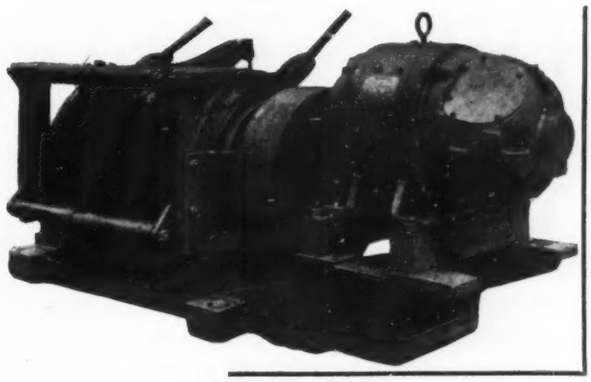
VULCAN IRON WORKS

WILKES-BARRE PENNSYLVANIA



SHAKING CONVEYORS

Vulcan Conveyors are ideal cost cutters for underground and surface service. Cut shows the famous ET-1 Drive.



SCRAPER HOISTS

Vulcan skill is reflected in this compact, rugged scraper hoist designed to stand up no matter how severe your requirements may be.

Photograph shows GUNITE at the bottom of slope at Hanna Mine No. 6, Lafferty, Ohio. Old timbers were removed and GUNITE applied, giving adequate roof and wall protection—and making a safe and comfortable place for the men to gather for safety meetings, etc.

GUNITE

as used by

HANNA COAL CO.

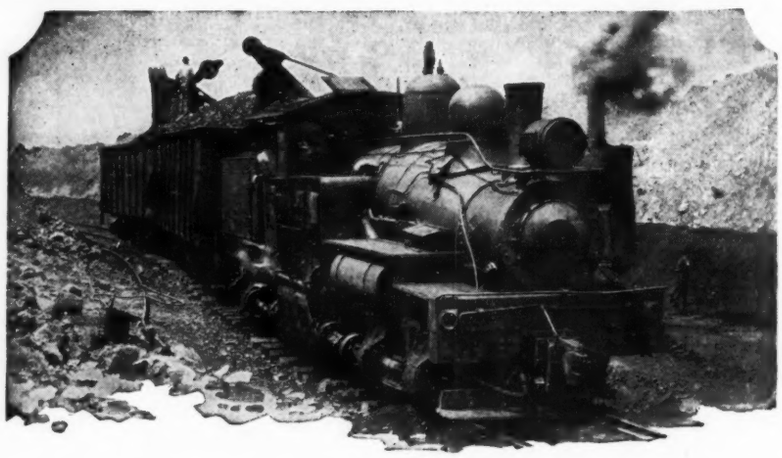
Has proved the most satisfactory method of roof protection, of lining slopes, shafts, underground substations and sumps.

All Gunite in mines of the Hanna Coal Co. applied by

GUNITE CONSTRUCTION CO., FAIRMONT, W. VA.

Specialists in Coal Mine Guniting

EXAMINATIONS MADE AND ESTIMATES FURNISHED WITHOUT OBLIGATIONS.



Spotting . .

WITH CONSISTENT ACCURACY!

When Shay Geared Locomotives spot cars under the shovel, there's no needless movement or slipping of driving wheels.

The cars are spotted at the first try . . . with consistent accuracy.

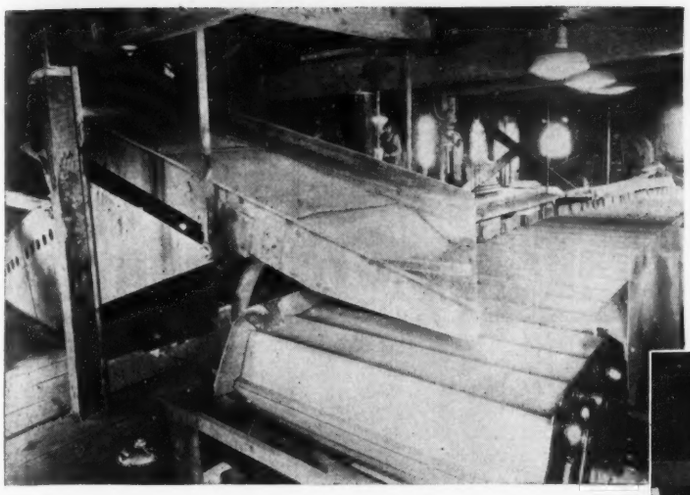
Shay Geared Locomotives are powered by three-cylinder engines. Two cylinders are always ready to pull when the other is on dead center. Consequently, Shay Geared Locomotives get off to an even start and maintain a steady pull. The result is faster . . . more accurate spotting.

Write for a copy of the Shay Catalog

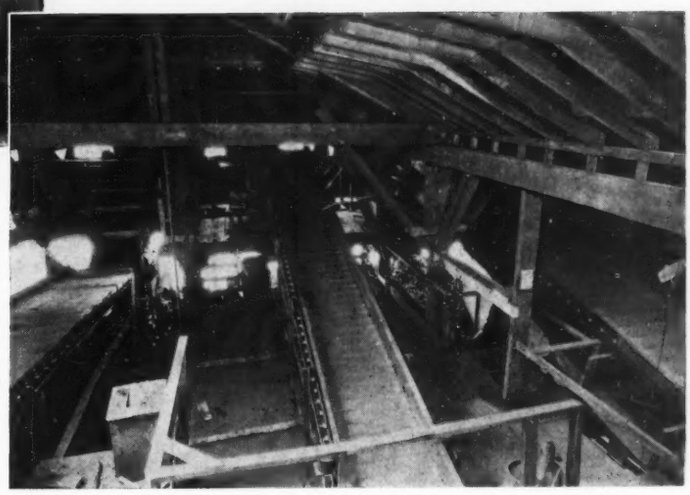
LIMA LOCOMOTIVE WORKS
Incorporated

LIMA, OHIO Sales Office: 60 East 42d St., New York, N. Y.

LIMA *Shay Geared* LOCOMOTIVES



Interior of Hanna Piney Fork No. 2 Tipple.



Another view of Piney Fork No. 2 Tipple. Showing egg, lump and slack loading boom.

HANNA proved the wisdom of Modernization —*with* MORROW TIPPLE EQUIPMENT

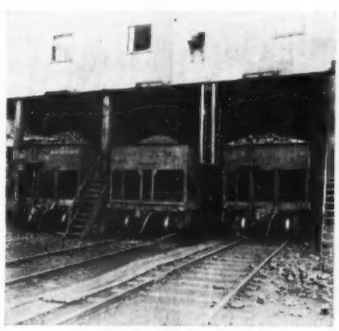
In 1930—Hanna modernized their Piney Fork No. 2 tipple by the installation of Morrow Equipment. This included a Morrow egg-picking table and boom, mixing conveyor, refuse conveyor, and elevator and bin.

This Morrow equipment has done more than set a standard of efficiency for the Hanna properties. It is meeting fully TODAY'S quickened pace set by this, one of the largest, most progressive coal companies in the State of Ohio.

Whether YOUR tipple is completely constructed or only partially equipped by MORROW—you can be certain of getting years of perfect service and satisfaction—at lowest cost—in coal handling and preparation. Experienced coal operators have known for years what the name Morrow means. The broad experience of Morrow Engineers is at your service to design and manufacture the equipment exactly suited to meet your requirements of today and the years to come. Why not capitalize it?

THE MORROW MANUFACTURING COMPANY
WELLSTON, OHIO

SHAKING SCREENS,
WEIGH PANS,
COAL FEEDERS,
ELEVATING AND
CONVEYING MACHINERY
LOADING BOOMS



Exterior view Piney Fork No. 2 Tipple.

PICKING TABLES,
LOADING CHUTES,
BINS, BIN GATES,
PERFORATED
METAL SCREENS

Heavy Duty Anderson Charging Plugs; made in various capacities for mine equipment.

Heavy Duty Anderson Charging Receptacles: made in different capacities; with or without third auxiliary contact.

Naturally — —
"HANNA COAL" uses
ANDERSON
Plugs and Receptacles

Wherever progressive mining companies use storage-battery locomotives, you'll find these safe, electrical connections for charging and for drawing power from the batteries.

Anderson Plugs and Receptacles are furnished in many types and sizes up to 600 amperes. Special mountings can be furnished for special conditions.

The Anderson design makes reversal of polarity impossible; the special insulation is mechanically strong and impervious to moisture; current carrying parts are liberally proportioned; the extra heavy seamless, tubular shell protects both plug and receptacle from hard usage and abuse.

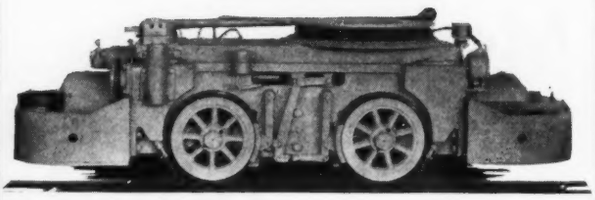
For gaseous mines we have a special design which is accepted for use with *permissible* equipment.

Write for full information.

Albert & J. M. Anderson Mfg. Co.
289-305 A St. Boston, Mass.
New York Chicago Philadelphia London

TRADE ANDERSON MARK
PLUGS & RECEPTACLES

Extra Pulling Power Through 4-Wheel Drive IRONTON LOCOMOTIVES



Two Out of Two at Piney Fork

Two storage battery locomotives are used at the Piney Fork No. 2 mine of the Hanna Coal Company. Both of them were furnished by The Ironton Engine Company.

The upper photo shows one of them. Both are Type WO.

Ironton locomotives are built in all types, including storage battery, trolley, and cable-reel, for any track gauge.

Connected axles with 4 wheel drive, gives better starting—better running—better stopping—in addition to increased draw bar pull.

Other features include enclosed worm gearing, dead silent, dust proof; ball and roller bearings throughout—accessible controllers—unusually sturdy construction—universal motor mounting.

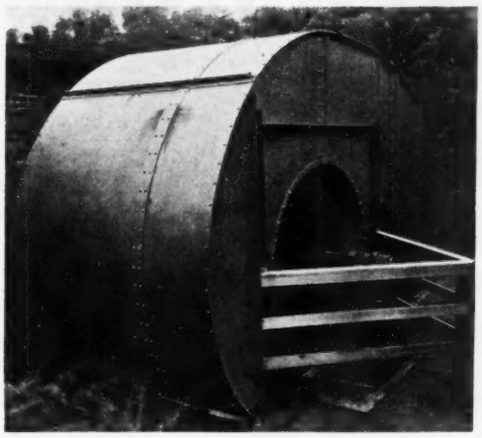
Ironton locomotives are giving excellent service in hundreds of mines. Write for more information.

We also manufacture Shaker Conveyors and Pit Car Loaders.

The
IRONTON ENGINE Company
IRONTON, OHIO

One of the first steps in modernizing Willow Grove

A ROBINSON FAN • • • • • •



● The most recent mine ventilating fan at the Hanna Coal Company is located at the Willow Grove operation, which is a Robinson BACKWARD CURVE, turbine type, double inlet Blowing Mine Fan, capacity 75,000 c.f.m. at its present operating speed. The speed can be increased for double the volume or reduced for any desired volume.

The recent installation of this fan indicates the progressiveness of the Hanna Coal Company where modern ventilation is concerned. Just recently the Hanna Interests have acquired the Willow Grove property and naturally pay a high tribute to Robinson Ventilating Company by the selection of their fan as one of the first steps toward modernization of the Willow Grove Mine.

Savings from the use of a Robinson Fan are so frequent that we have a special means of financing purchase.

Write for information on our plan for power savings without capital investment.

ROBINSON VENTILATING CO.

ZELIENOPLE . . . *Manufacturers of FANS and BLOWERS* . . . . . PA.

The type of Nolan Car Cagers used at Piney Fork No. 2 Tipple of the Hanna properties.

IT'S THE turn-around—the interval between loading and unloading—that makes schedules in transportation. It doesn't matter what kind of transportation, water, rail or truck.

Haulageways will hold so much rolling stock and no more. Additional rolling stock won't help speed up haulage schedules without additional trackage. Speedy turnaround of rolling stock is the only solution.

That's why Nolan Car Cagers are used on the haulage ways of Hanna Mines. That's why other leading mines everywhere use these and other Nolan car-handling devices.

Knowing your haulage conditions we will gladly recommend the type of Nolan devices to speed up your haulage schedules. Meanwhile you may get some valuable suggestions by reading "Mine Car Dumping and Control Devices." Shall we send a copy?

Some of the Nolan Devices for Speeding HAULAGE:

- Rotary Car Dumpers
- Automatic Gravity Dumps
- Cages
- Car Lock and Release for Cages
- Automatic Air Cushioned Bumper Stop Feeders and cagers
- Pneumatic Car Feeders
- Automatic Cushioned Horn Cagers
- Chain Trip Feeders
- Chain Trip Makers

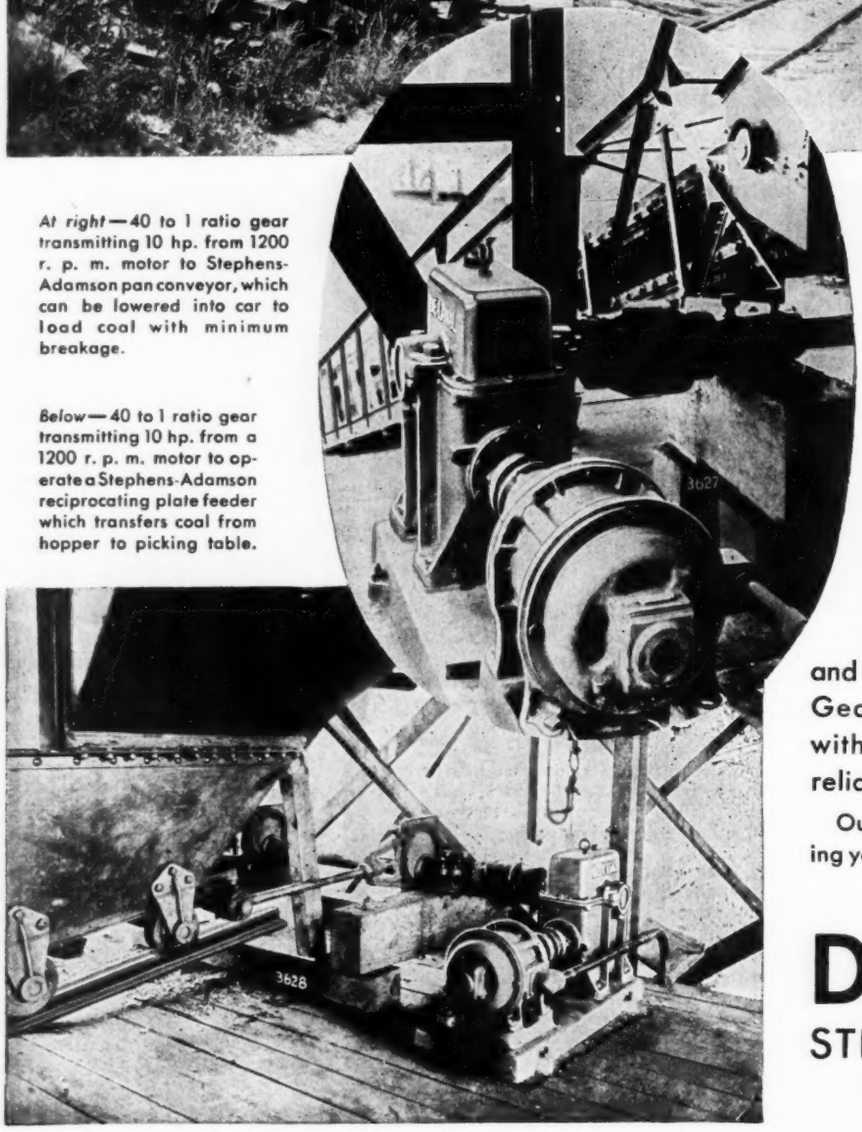
The Mining Safety Device Co. — Bowerston, Ohio

DE LAVAL WORM GEARS

Save Money on HEAVY WORK

At right—40 to 1 ratio gear transmitting 10 hp. from 1200 r. p. m. motor to Stephens-Adamson pan conveyor, which can be lowered into car to load coal with minimum breakage.

Below—40 to 1 ratio gear transmitting 10 hp. from a 1200 r. p. m. motor to operate a Stephens-Adamson reciprocating plate feeder which transfers coal from hopper to picking table.



IMPROVED coal handling machinery motor driven through De Laval worm reduction gears at this mine tipple saves $150 per operating day by reducing the percentage of slack coal and by increasing handling efficiency.

Correct cutting of the gears and liberal bearings, together with automatic lubrication and complete protection against grit and moisture, enable De Laval Worm Gears to carry heavy shock loads with high efficiency and complete reliability.

Our engineers will gladly advise concerning your most difficult transmission problems.

DE LAVAL
STEAM TURBINE CO.,
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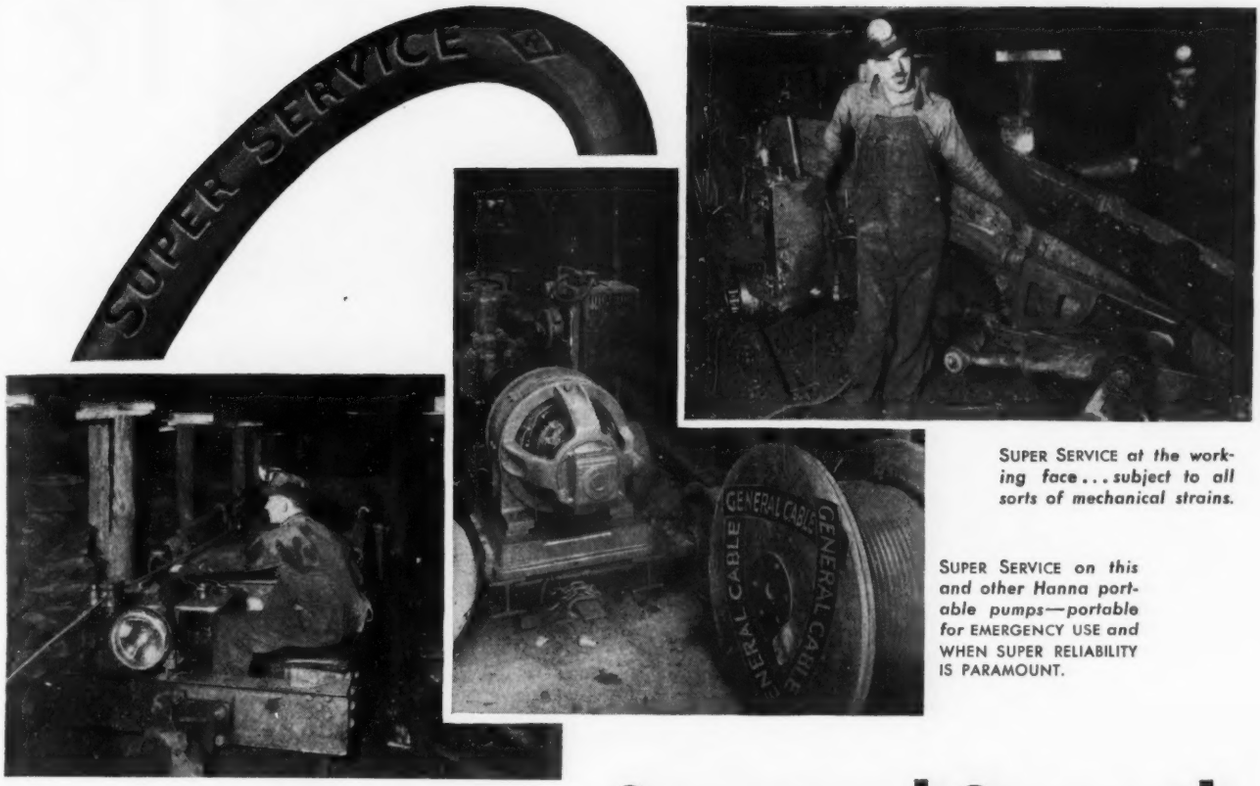

SUPER SERVICE *at the working face . . . subject to all sorts of mechanical strains.*

SUPER SERVICE *on this and other Hanna portable pumps—portable for* EMERGENCY USE *and* WHEN SUPER RELIABILITY IS PARAMOUNT.

SUPER SERVICE *on Hanna Coal's gathering locomotives at St. Clairsville—in constant service and with constant serviceability.*

Structural Strength beyond its own *Tough Hide*

Acid mine water—crushing weight—knifing abrasion! Any wonder that a flexible power lead that will fight back as successfully as SUPER SERVICE has a reputation? There may be other wires but there's only ONE...

OTHER GENERAL CABLE PRODUCTS FOR COAL MINES:

Power Cables, Bore Hole Cables, Telephone Cables, Trolley Wire, Lighting System Wires, Shot-firing Cable, Transmission Line Conductors.... Bare and Insulated Wires for Every Electrical Purpose.

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PORTABLE POWER CABLE

STANDARD NOT ONLY IN MODEL MINES BUT WHEREVER PERFORMANCE IS THE BUYING GUIDE

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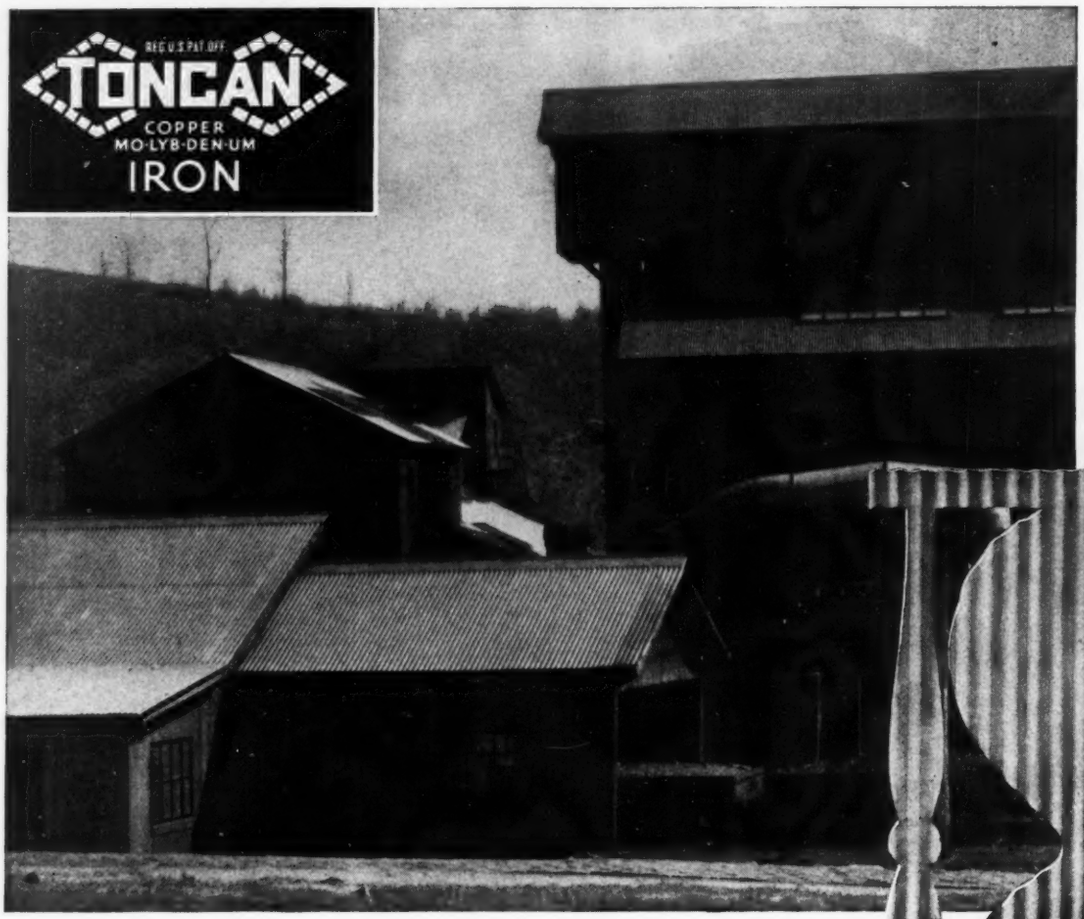

LASTS LONGER . . . ALWAYS ON TOPWORKS PLANTS

Topworks plants covered with corrugated metal fall into two classes—those covered with long-lasting Toncan Iron and those on which ordinary ferrous sheets have been installed. And the difference in the service life is accounted for in the difference in the materials.

Toncan Iron is an alloy of refined iron, copper and molybdenum. For 25 years it has been known as a stalwart in the fight against corrosion. In the coal fields its reputation is particularly bright, because of its inherent resistance to sulphur-laden air and water—a rust-resistance equalled by no other ferrous metal except the stainless irons and steels.

It pays to use a metal like this where conditions are severe—where continuous maintenance on other material soon far exceeds the slightly higher cost of installing Toncan Iron in the first place.

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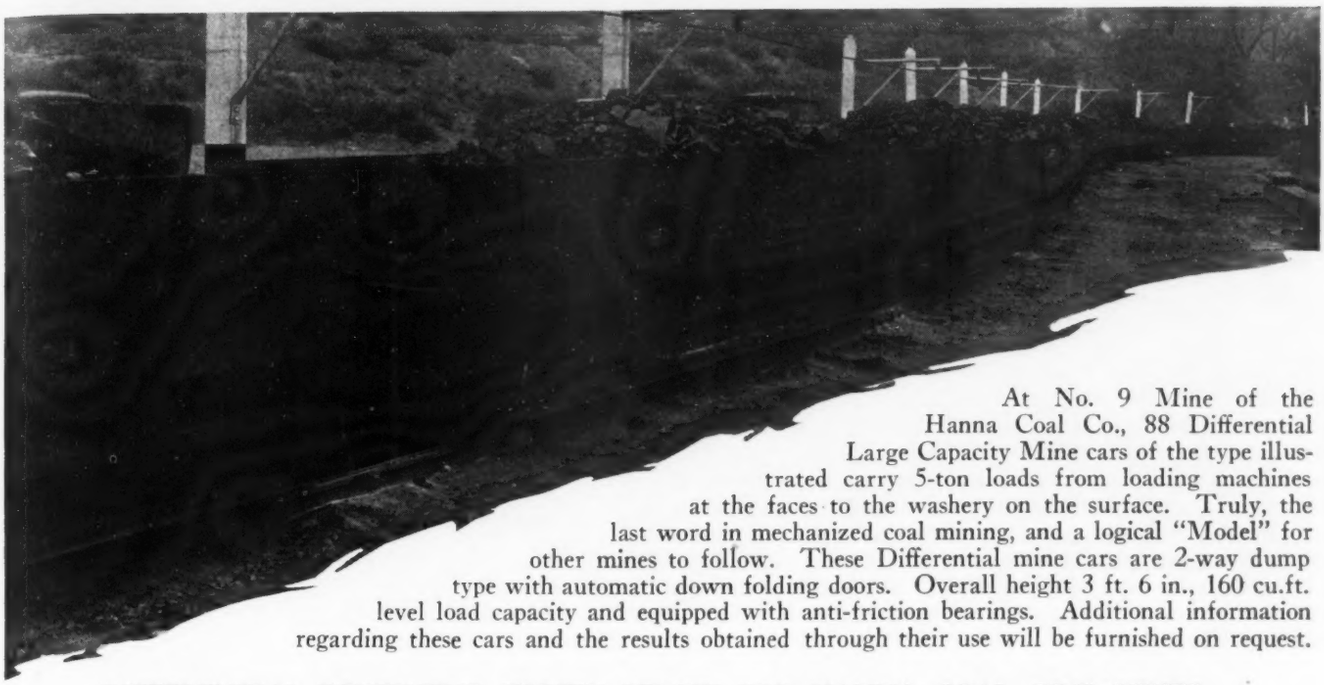
MINE CARS

CARRY 5-TON LOADS AT HANNA COAL COMPANY'S MECHANIZED MINE



At No. 9 Mine of the Hanna Coal Co., 88 Differential Large Capacity Mine cars of the type illustrated carry 5-ton loads from loading machines at the faces to the washery on the surface. Truly, the last word in mechanized coal mining, and a logical "Model" for other mines to follow. These Differential mine cars are 2-way dump type with automatic down folding doors. Overall height 3 ft. 6 in., 160 cu.ft. level load capacity and equipped with anti-friction bearings. Additional information regarding these cars and the results obtained through their use will be furnished on request.

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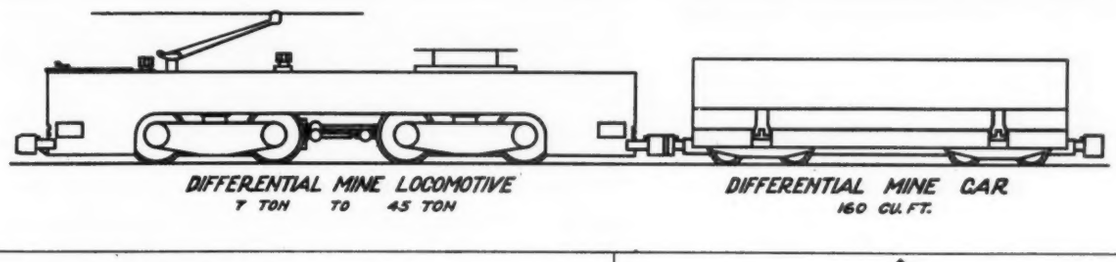
Complete information on any of the machines shown below furnished on request.
All these machines are of advanced design and effectiveness.



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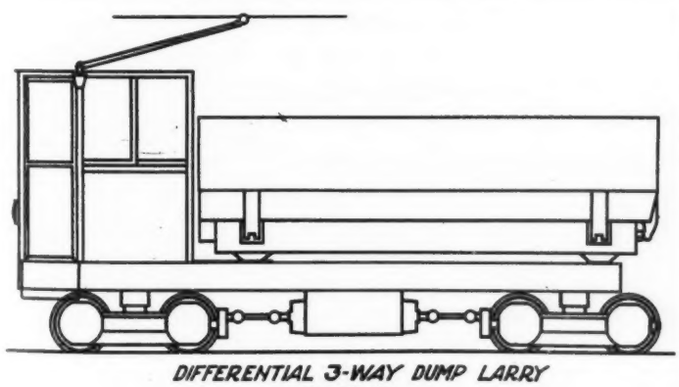
7 TON TO 45 TON

DIFFERENTIAL MINE CAR
160 CU. FT.



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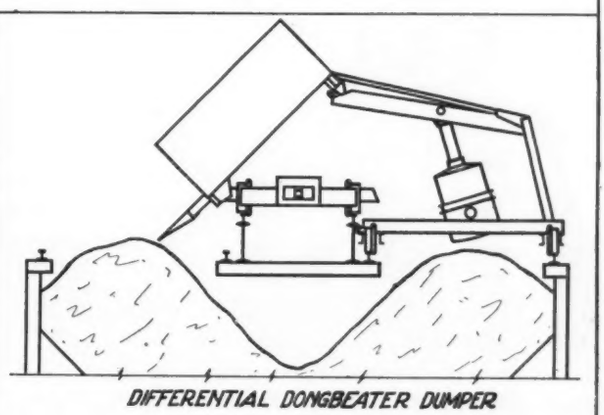
20 CU. YD.



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The modern mine has cut items such as road maintenance, track maintenance and idle equipment time, from their haulage costs. Overburden, coal and refuse now are hauled in the modern way, with LINN tractor trucks. Any road condition suits LINN, for its flexible traction unit negotiates the roughest terrain and steepest grades without effort. Weather, too, means nothing to LINN, for it pulls through muck and mire and over ice and snow with capacity payloads. Never is there any *time out* for LINN. And LINN'S huge payload capacity, high speed and ease of operation enable it to haul more yards per trip and make more trips per day. And at far lower cost, for the operating cost of both the gas and Diesel powered LINN is low, and its ability to stand punishment is well known. Facts are available covering LINN performance on many well-known operations. They will be of interest to mining companies and contractors anxious to modernize their haulage methods. Write for this information today.

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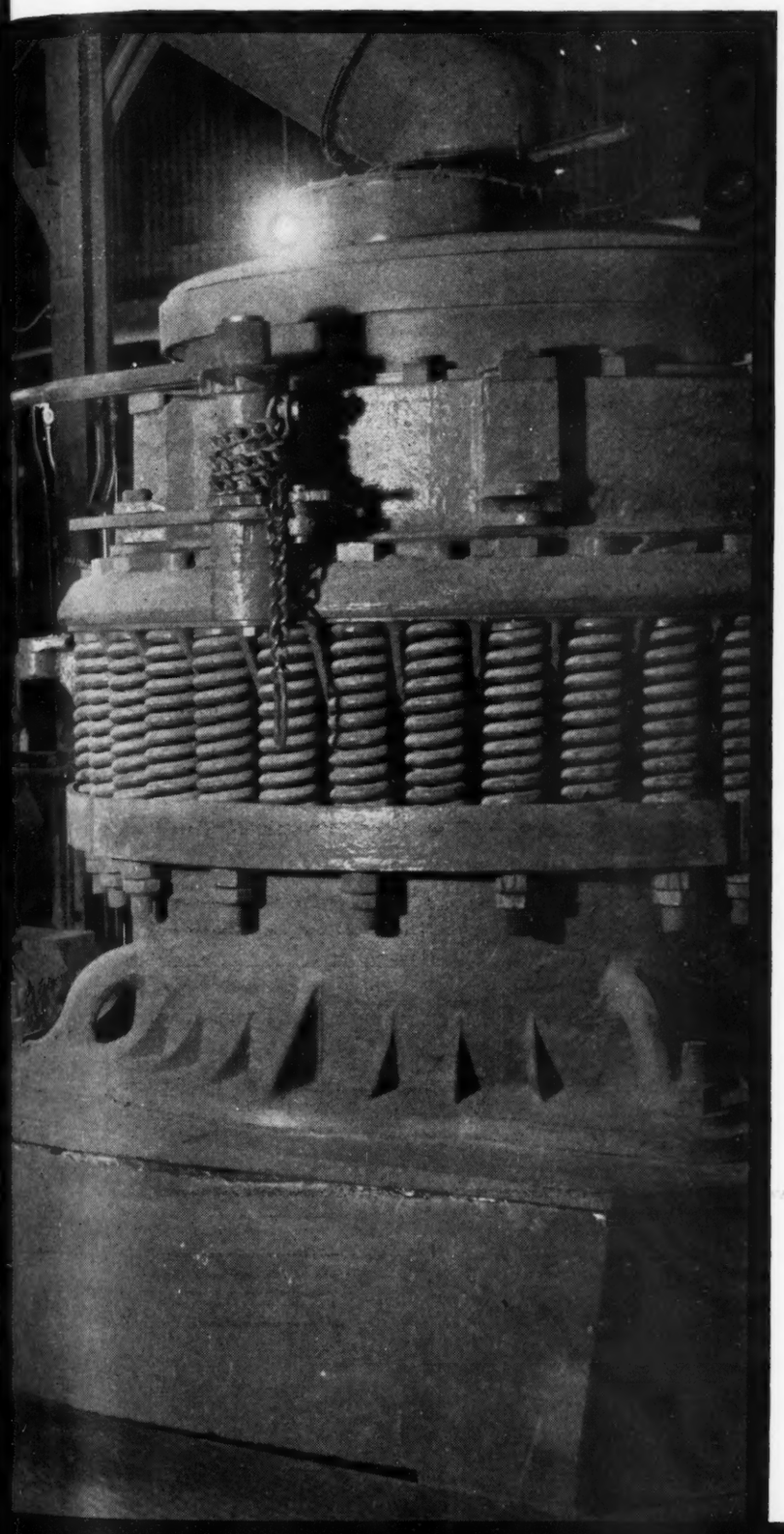

in the Lubrication of CRUSHERS and BREAKERS

It's a nip and tuck battle between lubrication on the one side and grinding dirt and enormous pressures on the other... The following excerpts are taken from a practical paper on the lubrication of crushers and breakers prepared by the Technical Staff of the Standard Oil Company (Indiana).

"The operating conditions of crushers, as a general rule, are extremely severe. Enormous pressures are exerted, and they are accompanied at times by severe shock loads . . ."

"The principal interference with good lubrication comes from the large quantity of dust and dirt that usually attends crushing operations. All lubricated surfaces must be protected against these abrasive contaminants" (practical suggestions are given.)

"The best means of lubrication for the gyratory type of crusher is the continuous circulating system. . . . A relatively heavy bodied oil of good quality to permit continuous use over long periods is required. . . . The particular choice of body will depend on the particular make and model of crusher involved and the season of the year, where low temperatures are encountered." (Expert advice is recommended.)

"In cold weather it is a good plan to start up with no load, letting the oil warm up to procure good circulation before imposing heavy loads on the bearings and gears."

(Roll Crushers, Jaw Crushers, and Hammer Mills are also treated in detail, and several practical suggestions given.)

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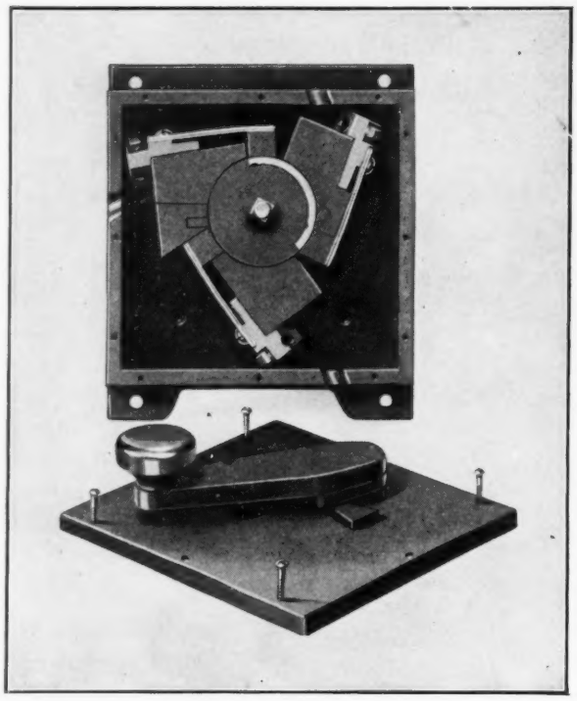

Announcement to the trade of Patented Bryant Bowdil Choke Arc Transfer Switch for reel or gathering motors and other applications embodying complete safety for the motorman, facilities for instantly cutting off power in case of fire in the motor wiring resistance or controller.

Extensive research and complicated automatic devices have been used to overcome the serious trouble to motors on account of the transfer switch. These switches have been in continual service since installation at no upkeep cost since that time. Important improvements have been made, in the present device these have been working one year trouble free.

By referring to the cut it will be noticed that the segment is flush with the periphery of the drum. The drum rotates between close fitting fiber finger blocks and finger tips. The arc choke is just in front of the finger tip and holds back the arc so if the switch is thrown under load any arc that might get past the choke blade will be instantly rubbed out between the fiber drum and finger block. This arrangement also requires the finger springs to operate without any bending except to keep the tip against the drum and as ample copper carrying capacity is provided the springs will remain efficient indefinitely.

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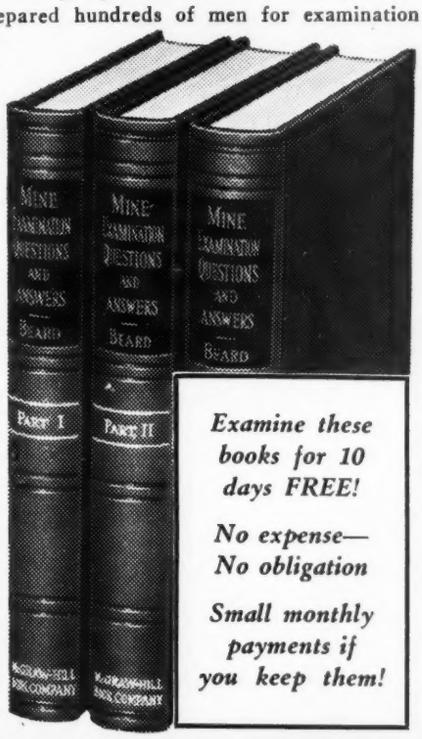

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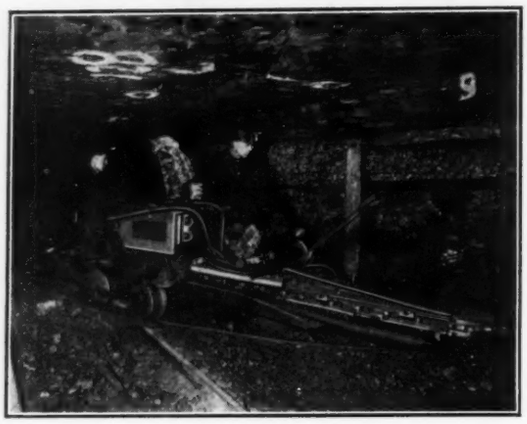

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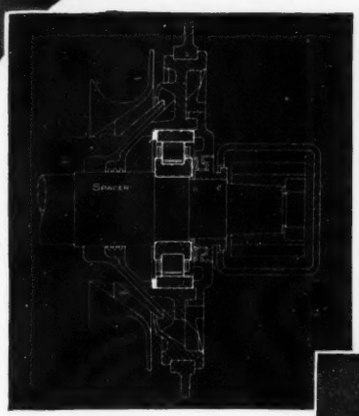
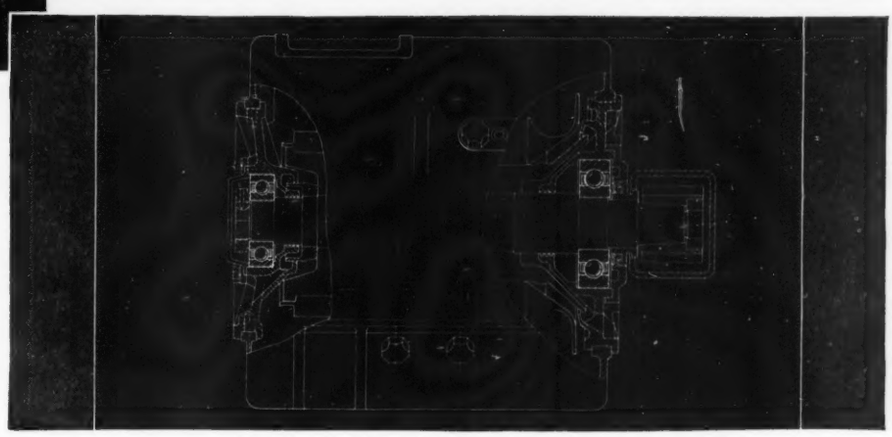


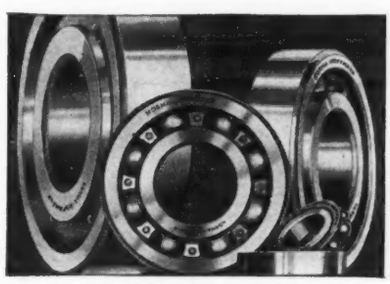
The drawing to the right shows a typical mine motor with ball bearings at both ends of the shaft . . . . The drawing above shows how simply a NORMA-HOFFMANN Roller Bearing can be substituted at the drive end.



Your own experience tells you that most locomotive motor troubles begin at the pinion end bearing—which is to be expected, considering that this bearing has a much heavier duty than the bearing at the other end. For it must carry not only the normal weight and shock but also the racking stresses and vibration of the gears.

The drawings above show how by a simple changeover at the pinion end from a ball bearing to a NORMA-HOFFMANN Precision Roller Bearing you can get the greater wearing surface and extra load capacity and added shock resistance you need. Without any change in housing design and at slight extra cost you can add to the life of your motors.

A NORMA-HOFFMANN Roller Bearing interchanges with any ball bearing. And by such an interchange, you gain:—greater load-carrying area where it is most needed; greater ruggedness and resistance to shock and vibration; a rugged, balanced, heavy-duty, bronze retainer; the superior accuracy and finish that go with PRECISION. These all combine toward longer life and lower maintenance cost.



Our engineers will be glad to furnish complete details of PRECISION Bearings for replacements on any mine locomotive. Just send us the locomotive type and serial number, and prices and data on recommended replacements will be supplied.

At the opposite end of your motor shaft, NORMA-HOFFMANN Precision Ball Bearings will give you extra dependability, too—with their rugged construction and their sturdy, balanced, machined bronze retainers.

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SEARCHLIGHT SECTION

(Continued on pages 86 & 87)

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MINING ENGINEER with twenty years' experience in positions of chief engineer, superintendent and general manager in southern West Virginia and eastern Kentucky, desires position with coal company. Employed at present. PW-364, Coal Age, 330 West 42d Street, New York City.

SALESMEN WANTED

SALESMEN, Selling Agencies or Electrical Contractors with technical understanding of—and contacts on—electrical power requirements of coal mines, wanted for complete sales coverage on new products of unusual merit. Products are definite economy producers involving no new money outlay to purchase—They Sell Now! To aggressive men territorial protection and an unusual compensation is available. SW-366, Coal Age, 330 West 42d Street, New York City.

"SEARCHLIGHT" RATES
Coal Age

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TRACTORS

Just purchased from U. S. Gov. 95 Caterpillar Holt 5 ton crawler type tractors almost new. Highly adaptable coal and lumber business. Ready to show and go. Price $350 ea. Locations Tobyhanna, Penn.; Ft. Bragg, N. C., will demonstrate. Also have ten ton size.

O. C. EVANS, Mt. Sterling, Kentucky

NEW and USED MACHINERY
OF EVERY DESCRIPTION

A complete line to service the mine

THE CENTRAL MINE SUPPLY CO.
Mount Vernon, Illinois
Manufacturers and Distributors of Mine Supplies

FOR SALE

1262 ACRES OF COAL

near Red Lodge, Montana. Very accessible and large tonnage. For further information write

K. H. B. Box 312, Red Lodge, Montana

—MINE EQUIPMENT—
FOR SALE—WANTED

Hoists, Boilers, Engines, Generators, Locomotives, Pipe, Tanks, Rail, Crushers.

MISSISSIPPI VALLEY EQUIPMENT CO.
511 Locust St., St. Louis, Mo.

FOR SALE

2—Steam driven, "Whirleys"—85-ft. & 75-ft. bms.
1—Electric driven, "Whirleys"—85-ft. boom.
1—Electric driven, "Whirleys"—107-ft. boom.
1—Elec. driven Crane—125-ft. bm.—3½-yd. bkt.
Steam Caterpillar Shovel—90-ft. bm.—6-yd. bkt.
Steam Caterpillar Shovel—28-ft. bm.—1⅛-yd. bkt.
Single and Double Drum Mine Hoists.
Picking Tables—Cars—Locomotives—Pumps.
W. P. HEINEKEN, Engineer, 95 Liberty St., New York

FOR SALE OR LEASE

2,000 Acres of Pittsburgh No. 8 Coal

located in Belmont County, Ohio, 4½ to 5 ft. in thickness, and no draw slate. There is a **truck mine** in operation on the property, **large storage bins, vibrating screening plant, Short-wall mining machines—E.T.C.**

FS-365, Coal Age
330 West 42nd Street, New York City

WANTED

Electric Rock Larry Car

One used hopper to revolve thru 180 degrees, 200 to 300 cu.ft. capacity. State condition, make, price, etc.

W-363, Coal Age
330 W. 42d St., New York City

WANTED

JOY LOADER

42-in. gauge. Must be in A-1 condition and bargain.

W-362, Coal Age
520 No. Michigan Ave., Chicago, Ill.

(Continued from page 85)

FOR SALE

MINING MACHINES

Several Jeffrey, Goodman and Sullivan, 250 volt D.C. and 220 volt A.C. Shortwall, all gauges.
4—Goodman type 319 Shearing Machines.
Several Jeffrey 29-B and 29-C Arcwall Machines.

STEEL TIPPLES

1—Morrow 4-track steel tipple with (3) loading booms, capacity 2000-ton.
1—3-track Roberts & Schaefer Steel tipple with (2) loading booms, capacity 2000-ton.
1—4-track Allen & Garcia Steel Tipple with (3) loading booms, capacity 4000-ton.
The above tipples were only in use a very short time and are like new. Bargains for quick sale.

MISCELLANEOUS

3—9x12 Bradford Coal Breakers.
4—44-C Jeffrey Loading Machines.
2—No. 3 Meyers-Whaley Loading Machines.
3—No. 4 Meyers-Whaley Loading Machines.
3—Jeffrey Motor Driven Gathering Reels for 6-ton MH-88 Jeffrey Gathering Locomotives.
4—5-BU Joy Loading Machines, late type.
1—300 kw., 500 volt Rotary Converter.
Motor Generator Sets and Rotary Conv'rs, from 100-300 kw., 250/275 volt D.C., 2300 volt A.C.
2—Goodman Power Shovels, 250 volt D.C.
2—Goodman Entry Loaders, type 136-A.
500—4-ton mine cars, 42-in. gauge, end gate type, 52-in. high overall.
200—Rotary Dump all steel mine cars, 33-in. high overall, 42-in. gauge.
Jeffrey 6-ft., 8-ft. and 10-ft. all steel fans.

Mail Us Your Inquiries, We Have Practically Anything You Might Need in Good Used Mine Equipment.

Coal Mine Equipment Sales Co.
306-7 Beasley Bldg., Terre Haute, Indiana

MINE EQUIPMENT FOR RESALE

1—Steel Tipple Shaker Screen and Loading Booms.
1—36-in.x150-ft. Belt Conveyor.
2—Goodman Power Shovels on caterpillar trucks.
1—Sullivan Shearing Machine, 250 v., 48-in. ga.

REBUILT EQUIPMENT IN STOCK

212-AA Goodman Low Vein Mining Machines.
112-AA Goodman Universal Mining Machines.
12-AA Goodman Standard Mining Machines.
29-C Jeffrey Arcwall Mining Machines.
29-B Jeffrey Arcwall Mining Machines.
4—CE7 Sullivan Machines.
Oldroyd Mining Machine.
H. M. 825 G. E. Low Vein Gathering Locomotives.
M. H. 96 Jeffrey Gathering Locomotives.
HM 58 Locomotive, 250 v.
HM 52 Locomotive, 250 v.
Goodman 8-30 Locomotive with reel
10-ton MH110 Locomotive.
13-ton 102D Locomotive.
Jeffrey, G. E. and West. Haulage Locomotives.
150 and 200 kw. late type G. E. Motor Generators.
100 kw. G.E. HCC Rotary Converter.
Wheel Lathe for steel tires up to 48-in. dia.
Resistance for Mining Machines and Locomotives.
1—Overhead Hoist, 3½ ton, self propelling, 250 v.
4—906 West. Motors, 250 v.
3—Fairmont Car Retarders.
1—Belt Conveyor, 14-in.x35-ft.
10—Reels for gathering locomotive, G.E., West. and Goodman.
Goodman Machine Motors, A.C. and D.C.
A.C. and D.C. Motors. Please send for stock list.

GUYAN MACHINE SHOPS, LOGAN, W. VA.

FOR SALE

Secondhand Equipment consisting of

Locomotives,
Motor Generator Sets,
Miscellaneous Motors,
DC and AC,
One Steel Tipple Complete

For full particulars address

CONTINENTAL COAL COMPANY
Fairmont, W. Va.

LOCOMOTIVES

2—15 ton **JEFFREYS**, 250 V. O. S. Armor Plate Frames, MH-110 Motors, 7500 DBP, 42" or 36" ga. Locomotives are duplicates, and will make excellent tandem units. Extra armature and trucks. Ready for immediate service.
1—10 ton **JEFFREY**, 250 V. I. S. Armor Plate Frame, O. S. Steel Tired Wheels. MH-104 Motors, 42" or 36" ga. This unit very modern, and ready for service.
1—10 ton **GENERAL ELECTRIC**, Type LM-2-C-10-AA-16, 250 V. O. S. Rolled Steel Frame, HM-809-F Motors, 44" or 36" ga. Extra armature and trucks. Locomotive re-conditioned, and ready for immediate service.
2—8 ton **WESTINGHOUSE HAULAGE TYPE**, 250 V. O. S. Bar Steel Frames. 906-C Motors. Present gauges 44" and 36". Locomotives are duplicates, and have been thoroughly modernized and re-conditioned.
1—6 ton **JEFFREY CRAB REEL GATHERING TYPE**, 250 V. O. S. Steel Tired Wheels, MH-88 Motors. Equipped with Jeffrey Vertical Type motor-driven crab reel, 42" or 36" ga. Locomotive has been overhauled, and is ready for immediate service.
1—6 ton **GOODMAN GATHERING TYPE**, 250 V. O. S. Rolled Steel Frame. Type 33-04-T2 Motors. Equipped with horisontal type motor-driven cable reel. 42" or 36" ga. This locomotive is virtually brand new.

Send for our new list No. 11134 of Coal Mining Machinery.

Wallace E. Kirk Company
Grant Building Pittsburgh, Pa.

FOR SALE

ALL STEEL CARS

18—Sanford-Day 6-ton, drop-bottom. 42-in. ga.

LOCOMOTIVE

1—14 ton Vulcan. 9x14, 42 in. ga. A real bargain. Just the thing for a strip mine.

FS-324, Coal Age
520 No. Michigan Ave., Chicago, Ill.

FOR SALE

ROTARY CONVERTER
200 kw., 250 v. D.C. Westinghouse and Trans.
M.G. SET
200 kw., 250 v. D.C. Gen. Elec. with 300 hp., 514 r.p.m., 3/60/4000 v. synchronous motor.
A.C. GENERATORS
25 kva., 1800 r.p.m., 3/60/2300 Fairbanks-Morse.
37 kva., 1200 r.p.m., 3/60/220 General Electric.
150 kva., 600 r.p.m., 3/60/220 General Electric.
OIL ENGINES
15 hp., 330 r.p.m. Venn Severin semi-diesel.
100 hp., 250 r.p.m. Bessemer semi-diesel.
AIR COMPRESSORS
14 and 9x12, 446 c.f.m. Ingersoll-Rand type XB.
16 and 10x14, 599 c.f.m. Ingersoll-Rand type 10.
CENTRIFUGAL PUMPS
1000 g.p.m., 170 ft. head American belted 2 stage.
1500 g.p.m., 170 ft. head Allis-Chalmers, 3 stage.
VARIABLE SPEED MOTOR
25 hp., 400/1200 r.p.m., 230 v. D.C. Gen. Elec.

ROCKFORD ELECTRIC EQUIPMENT CO.
724 South Wyman St. Rockford, Ill.

CUTTING MACHINES

212 G3 Goodman, AC, Low Vein shortwall.
35 BB Jeffrey, AC, Shortwall—any type of truck.
12 DB Goodman, 250 v. DC, Revers. Shortwall.
28 A Jeffrey, 250 v. Shortwall.
24 A Jeffrey, 250 v. Longwall.
35 B Jeffrey, 250 v. Shortwall.

(All the above completely rebuilt)

MOORHEAD-REITMEYER CO., Inc.
Columbia Bldg., Pittsburgh, Pa.

IRON AND STEEL PIPE

Large quantity new and used Government material in excellent condition, ready for immediate shipment. Low prices.

CENTRAL PIPE & SUPPLY CO.
Box 1099, Charleston, W. Va.

SOUND VALUE BARGAINS

1—13-ton, 250 v., 44-in. ga. Goodman Locomotive, No. 36 BB motors.
2—10-ton, 250 v., 42-in. ga. G.E. Locomotives, HM 809-BB motors.
3—6-ton, 250 v., 44-in. ga. G.E. Locomotives, BB motors.
1—No. 48 American Ring Hammer Mill, cap. 100 TPH to 1¼ in.
1—24x24 Stephens Adamson Double Roll Coal Crusher.
1—24x20 Jeffrey Coke Sizer.
1—750-hp. Lidgerwood Slope Hoist.
1—50-hp. Lidgerwood Elect. Hoist.
1—500 kw., 250 v. Westgh. M.G. Set.
1—300 kw., 250 v. Gen. El. M.G. Set.
1—200 kw., 250 v. Gen. El. M.G. Set.
1—150 kw., 250 v. Westgh. M.G. Set.
1—100 kw., 250 v. Ridgway M.G. Set.

For Particulars Wire, Phone or Write

JOHN D. CRAWBUCK CO.
Empire Bldg., Pittsburgh, Pa.

SPECIAL BARGAINS

2—13 Ton Jeffrey Electric Locomotives, each equipped with two MH-110 250 volt D.C. Motors.

3—35-B Jeffrey 250 volt Cutting Machines.

1—CLE Sullivan Longwall Mining Machine, 250 volt.

We have other equipment.

TIPPINS & SPRENGLE, INC.
Koppers Building, PITTSBURGH, PA.

GOOD USED PIPE

FOR SALE

100,000 feet 2"
25,000 feet 3"
5,000 feet 4"

all with threads and couplings, ready to use.

THE TRI-STATE PIPE COMPANY
31st and Guernsey Sts., Bellaire, Ohio

GOOD MINE EQUIPMENT

LOW PRICED

Mining Machines, Jeffrey, Goodman and Sullivan, D.C. and A.C., Shortwall, Longwall and Track Machines, all late types, any gauge.
Locomotives from 4 to 15 ton, Gathering and Haulage, Jeffrey, Goodman GE and W-B, all gauges.
Rotary Converters and **Motor Generator Sets** —100 to 500 K.W.
Tipples, Electric Hoists, Crushers, Conveyors, Compressors and all kinds of mine equipment.

Send us your inquiries—we can supply your requirements.

Stock list upon request.

INDUSTRIAL EQUIPMENT CORP.
P.O. Box 110 Pittsburgh, Pa. — **Office & Warehouse Carnegie, Pa.**

Reconditioned

PIPE

New Threads—New Couplings
Valves—Fittings—All Sizes

Marine Metal & Supply Co., Inc.
167 South Street, New York City

POWER GENERATING EQUIPMENT

2—1250 KW. A.C. TURBO UNITS
New 1921

2—516 HP. STIRLING BOILERS
New 1924

1—400 KW. A.C. UNIFLOW UNIT
New 1923

1—500 KW. ROTARY CONVERTER
New 1924

1—150 KW. SYNCHRONOUS M.G. SET
New 1920

The NATIONAL POWER MACHINERY CO.
1915 Scranton Road Cleveland, Ohio

LOCOMOTIVES

2—6-Ton Jeffrey 240 v. 36 or 42" Ga. MH88 Ball Bearing Motors, steel tires, equipped with Jeffrey reel or crab.
3—6-Ton G.E. 250 v. 42" Ga. B.B. Motors, steel tires with reel.
8-Ton Jeffrey 250 v. 36" Ga. MH 100 B.B. Motors, armor plate frame.
13 Ton Goodman armour plate, 36 or 42" Ga.

MOORHEAD-REITMEYER CO., Inc.
Columbia Bldg., Pittsburgh, Pa.

Dependable **Economical**

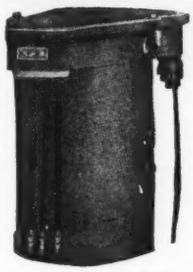
Hi-Grade-Rebuilt

ELECTRIC MOTORS

and Machinery

GREGORY ELECTRIC COMPANY
Lincoln & 16th St. CHICAGO

TRANSFORMERS



A Complete Stock. Prompt Shipment.

3—500 KVA Pittsburgh Transformers, 60 cycle, 6900/13800-220/440 volts. **$900.00** EACH

We Rewind, Repair and Redesign all Makes and Sizes.
ALL TRANSFORMERS GUARANTEED FOR ONE YEAR

Write for Catalog No. 129-B

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M CINCINNATI, OHIO

FOR SALE

2—**15-TON LATE TYPE JEFFREY HAULAGE LOCOMOTIVES,** now 42-in. gauge, can be changed down to 36 in., speed 6 M.P.H., 66-in. wheel base, inside 33-in. wheels, steel tired, double ball bearing motors—MH-110, 250 volt D.C., armorplate 3½-in. frame, 4½-in. axle, MB-26E controller, equipped with Crouse Hinds Headlights. Both locomotives have been completely overhauled from one end to the other and are just as good as new.

1—**10-TON GENERAL ELECTRIC LOCOMOTIVE,** serial No. 7873, 809 ball bearing motors, 250 volt D.C., 44-in. gauge, can be changed to 42-in. or down to 36-in. gauge, controller R-114E, height overall 38 in., 60-in. wheel base, steel tired inside wheels, armorplate frame. This locomotive has been completely overhauled and is complete with new tires, brake shoes, axle and journal bearings, wiring and we also have with it one extra armature. Price, complete with extra armature.

4—**GOODMAN 30-B 5-TON GATHERING LOCOMOTIVES,** equipped with reels, 42-in. gauge, 250 volt D.C., 29 in. high overall, completely overhauled, also complete with brand new tires.

3—**JEFFREY MH-88 6-TON GATHERING LOCOMOTIVES,** 42-in. gauge, 250 volt D.C., equipped with horizontal reel and cable. These locomotives have been completely overhauled and are in excellent condition throughout.

8—**GOODMAN 12-AA, 50 H.P., 250 VOLT D.C., SHORTWALL MINING MACHINES,** 42-in. gauge, 6½-ft. cutter bars, complete with reel and 300 ft. of good Rubber Covered Tirex Cable.

2—**300 K.W. GENERAL ELECTRIC SYNCHRONOUS ROTARY CONVERTERS,** type HCC-6, form P, 2300 volt A.C., 250/275 volt D.C., complete with transformers, switchboards and all necessary appurtenances. Like new.

COAL MINE EQUIPMENT SALES COMPANY
306-7 Beasley Building
Terre Haute, Indiana

MINE EQUIPMENT

. . . FOR SALE . . .

Modern four-track **Steel Tipples, Rescreeners, Shaker Screens, Loading Booms, Motor-Generator Sets, Engine-Generator Sets, Mine Locomotives, Pit Cars, Mining Machines, Pit Car Loaders, Electric** and **Steam Hoists, Pumps, Motors** and **Mine Supplies.**

Complete mines dismantled and sold.

CHARLES EDWIN HAIR
Mine Equipment and Supplies
301 West Reed Street, Benton, Illinois

BARGAINS

1—3-ton **Plymouth Gasoline Locomotive,** 36" gauge.

1—4-ton **Plymouth Gasoline Locomotive,** 36" gauge.

1—6-ton **Goodman Haulage** 250 V. DC 36, 39 or 42" gauge, factory rebuilt.

1—6-ton **Ironton Storage Battery Locomotive** 36 or 42" gauge.

1—10-ton **Jeffrey** 250 V. DC 36 or 42" ga.

1—**CE-7 Sullivan** 250 V. DC 36" gauge.

3—12 G-3 **Goodman** AC 220 V. 3 ph. 60 cy. 36 or 42" gauge 6' cutter bar.

2—100-kw. **Ridgway** MG Sets 250 V. DC 1200 r.p.m. 2200 V. 3 ph. 60 cy. AC complete with switchboards, factory rebuilt.

1—150-kw. **Crocker-Wheeler,** 250 V. 3 ph. 60 cy. 220/440 or 6600 V. AC complete.

1—6-ft. **Stine Fan** with 2 speed AC Motor, chain and sprockets.

1—5BU **Joy Loading Machine.**

1—75-hp. **Ottumwa Hoist** 2000' ¾" cable with 75 hp. AC Slipring Motor.

Duquesne Electric & Mfg. Co.
Pittsburgh, Pa.

COAL CRUSHERS

30"x30" Jeffrey single roll coal crusher arranged for belt drive rebuilt condition.
20"x24" Link Belt coal crusher, belt drive, rebuilt condition.

(Send for our list of mining machinery.)

MOORHEAD-REITMEYER CO., Inc.
Columbia Bldg., Pittsburgh, Pa.

CARS

33—12-yd. Western Air or Hand Dump.
42—40-ton Wood Gondolas, Low Price.
18—20-yd. Koppel Steel Air Dump.
100—50-ton Steel Hopper Coal Cars.

Also Locomotives of all types and weights.

Generator-Converter Sets, Hoists and Heavy Mine Equipment.

RAILS

Large stock First-Class Relay Rails and Bars, all weights. New light Mine Rails. Tie Plates, Switch Layouts, etc. Get our prices.

HYMAN-MICHAELS COMPANY
20 N. Wacker Dr. Bldg., Chicago
Railway Exchange Bldg., St. Louis, Mo. — 101 West 31st St., New York

Electric Hoists

Modern Type Vulcan - Ottumwa, Lidgerwood, etc., 5 to 500 hp. Shaft, Slope and Tailrope Haulage Hoists.

Motor Generator Sets and Rotary Converters

Complete Gen. Elec., Westgh. and Ridgway late type, 50 to 500 kw., Mining Substations.

Mine Locomotives

Late Type Jeffrey Goodman, Baldwin, Westgh. and Gen. Elec. Haulage and Reel Type Locomotives, 4 to 15 ton, 250/500 v., 36, 42, 44, 48 in. ga.

Mining Machines—Loaders—Conveyors—Compressors — Fans — Pumps — Tipple Equipment — Steam, Oil and Gas Power Plants—Crushers.

SPACE WILL NOT PERMIT LISTING EXCEPTIONAL BARGAINS FOR SALE

Mail, Phone or Wire your inquiries to

JOHN D. CRAWBUCK CO.
GENERAL OFFICES
Empire Bldg., Pittsburgh, Pa.

MINE RAILS

Guaranteed Practically Equal to New.
Super Quality Machine Reconditioned—not ordinary Relayers.
Standard Modern Section and Drilling
6,000 ton—20 lb. to 40 lb.
10,000 ton—45 lb. to 130 lb.
Priced at $200 to $500 per carload less than cost of New Rails. Less carload—in proportion.
Fully Guaranteed--shipped anywhere—subject inspection and approval at your Mine.

NEW RAILS, FROGS & SWITCHES, SPLICE BARS, TIE PLATES, BOLTS, NUTS, SPIKES, GAUGE RODS, OTHER ACCESSORIES.

Shipment from stock. Phone, write, or wire for quotation.

L. B. FOSTER CO.
PITTSBURGH-CHICAGO-NEW YORK

GET READY FOR THE SIX HOUR DAY

200 Steel Mine Cars like these. →

Also 50 Wooden Cars.

3 TON CAPACITY
42" GAUGE
with Rotary Dump

Other Equipment including:
8 Cutting Machines,
5 Pitcar loaders,
1 Bradford Breaker,
11 Locomotives.

Terms: CASH or WILL INVEST

C. A. REIS, Green River Mine, Mogg, Ky.

RELAYING RAILS

All sections ready for immediate stock shipment.

Also frogs, switches, spikes, bolts, new and secondhand mine cars 36" and 42" gauges, mining machinery, etc., in stock.

M. K. FRANK
480 Lexington Ave., New York City — P. O. Box 1234, Pittsburgh, Pa.

TRANSFORMERS & MOTOR GENERATOR SETS

We specialize in rebuilt guaranteed Transformers, M-G Sets, and Rotary Converters, any size.

We have a large stock of these rebuilt items available for prompt shipment.

MOORHEAD-REITMEYER CO., Inc.
Columbia Bldg., Pittsburgh, Pa.

LEHIGH SAFETY SHOES

INDUSTRY WORKS IN

No. 839 Black Elk Double Oak Sole, 13 Nailed Rubber Heel, Improved Steel Box Toe, Leather Counter, Leather Vamp Lined and Grain Inner Sole.

No. 838 as above except Army Grid Rubber Sole and Heel.

THE Lehigh Safety Shoe Company have been manufacturers of Safety Shoes for a good many years. Through their close association with Industry they have developed a complete line of Safety Shoes to meet the requirements of all Industries.

Thus, you can be assured when you specify Lehigh you will receive shoes with the improved steel box toe, designed to meet your needs and that will give your workman needed protection and comfort.

Your request for information about Lehigh Line will be quickly answered. Write for a list of the Lehigh Safety Shoes in stock for at once shipment.

Make it a habit to wear Safety Shoes.

LEHIGH SAFETY SHOE CO. Inc.

31-33 So. Seventh St. Allentown, Pa.

Gentlemen: I am interested in your model 839 safety boot. Please send me prices and complete information—also samples on approval as checked below.

☐ 12 pair assorted SIZES.
☐ 1 pair, for personal use, SIZE.....

All orders sent C.O.D. unless credit has been established.

Name .....

Position or Title.....

Company .....

Address .....

"Never Lets Go"

ALLIGATOR

TRADE MARK REG. U.S. PAT. OFFICE

STEEL BELT LACING

For belts of all kinds and sizes. "The most universally used belt lacing on earth." Holds belt ends in vise-like compression grip. Separable. Joint usually lasts as long as the belt. Rocker hinge pin protects lacing against internal wear. Reliable for use wherever a belt will give efficient service. In 11 sizes for belts from tape up to 5/8 inch thick. Made also in MONEL Metal.

Sold the World Over

Sole Manufacturers

FLEXIBLE STEEL LACING CO.

4638 Lexington Street Chicago, Illinois

In England at 135 Finsbury Pavement, London, E.C.2

Accept No Substitutes

TRADE MARK REG. U. S. PAT. OFF.

OLSON *Self-dumping* Cages

Will Speed up Your Hoisting!

Is hoisting the "bottle neck" at your mine? The improved OC-7 Type Olson Self-dumping Cage—holder of world's tonnage records—quickly pays for itself through improved hoisting speed and increased production per shift. Built to meet any individual requirements. Write for Bulletin OC-7.

Other Eagle products: Specialists in the design and manufacture of mine cars, loading booms, picking tables, chutes, hoppers, bulkheads, screens, weigh pans, sheaves, car retarders, crushers, hoists.

EAGLE IRON WORKS

Des Moines, Iowa

USE

PLAT-O

COAL WASHING TABLES

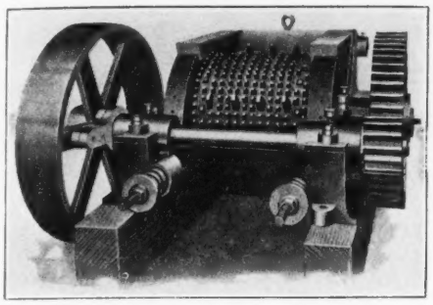
For cleaning your small coal for stoker or other purposes—Will remove 90% to 95% of free impurities—large capacity—small cost.

Our many years of experience in this work is at your service—advise details of your requirements—write for Bulletin No. 16B.

DEISTER MACHINE COMPANY

1933 E. Wayne St., Fort Wayne, Indiana

"UNITED"



Single or double roll crushers and Needle Splitting Breakers for preliminary or fine crushing.

Modern Equipment designed and built in our own factory. Any item of equipment or completely erected plants.

LONG WALL FACE CONVEYORS

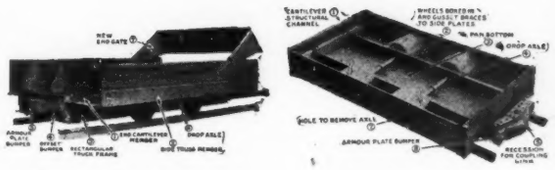
Loading Booms	Pumps
Cages	Car Retarders
Cars	Shaker Screens
Conveyors	Vibrating Screens
Elevators	Sheave Wheels
Rotary Dumps	Sulphur Rattlers
Feeders	Washing Plants
Picking Tables	Weighing Pans
Electric Hoists	Ventilating Fans
Drill Rigs	Trailer Trucks

Repairs for Steam and Electric Shovels

UNITED IRON WORKS COMPANY
FACTORY—PITTSBURG, KANSAS
SALES OFFICE—KANSAS CITY—MO.

S & D "Cantilever-Constructions"
(Pat'd and Pat's Pending)

FOR S & D "WHOPPERS"



Whopper Saw-Tooth End-Dump

Whopper Rotary

Our Biggest Capacity Cars

Not only do these cars have large capacity, but they are Strong — Flexible — Simple — Easily Repaired and have No Unnecessary Weight, Rivets or Forgings.

On account of using the same "Cantilever" design in "Whoppers" and "Automatics" we have been able to standardize the construction and thus reduce unit cost.

To prove this statement to your satisfaction, compare our prices on a cubic foot basis.

Special Terms—Leasing or Selling

...A Menace to Profits!

● In Coal Mining, stub-pencil records are a constant menace to profits.

We refer specifically to hand-written records of coal-weights taken at the tipple. Since miners' wages, based on these weights, represent over 60% of your costs, the accuracy of these tipple-weights is of vital importance in profitable mine operation. Now, more than ever before, coal must be accurately weighed—and the weight must be quickly and accurately recorded.

A Permanent Solution—The Toledo Printweigh forever eliminates errors in weight-recording. It certifies the accuracy of these basic weight-records by delivering an accurate, legible, machine-printed record of the weight of each mine-car passing over the scale. In addition, it records the date, hour, miner's check number and location in the mine from which the car came. It operates automatically and prints in less than 1/10 second.

A Practical Suggestion—We urge that you investigate Printweigh's many profit-protecting features. Write for a copy of "Progress in Industrial Weighing"—a condensed fact-summary of printed weight-recording.

Better still, see **"On Guard"**—a 20-minute Toledovision talking picture, which presents Printweigh quickly, concisely, authoritatively. Simply instruct your telephone operator, "Phone the nearest Toledo Scale Company office to send over On Guard." A Toledovision operator will handle all details. The presentation will be made at your convenience, in your own office. No obligation, of course.

TOLEDO SCALE COMPANY
TOLEDO • OHIO
NO SPRINGS • HONEST WEIGHT

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This index is published as a convenience to the reader. Every care is taken to make it accurate, but *Coal Age* assumes no responsibility for errors or omissions.

*Where an asterisk precedes manufacturer's name, more detailed information may be found in the 1934 edition of *Coal Mining Catalogs.*

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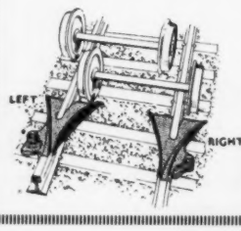

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